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NATIONALLY APPROPRIATE MITIGATION ACTION: RURAL DEVELOPMENT IN NAMIBIA

THROUGH ELECTRIFICATION WITH RENEWABLE ENERGIES

United Nations Development Programme

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FOREWORD

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 ***United Nations Framework Convention on Climate Change (UNFCCC)*** and Kyoto Protocol (COP13) in Bali in 2007.

NAMAs shall help countries achieve their growth objectives and participate in the global climate change mitigation agenda. NAMAs help governments leverage national and international support to achieve appropriate, effective and transformational GHG mitigation and sustainable development targets for the country and within communities. COP 19 in 2013 saw the introduction of Intended Nationally Determined Contributions (INDCs), which were to be submitted by all parties to the UNFCCC, both developed and developing countries.. The INDCs are for the period following 2020 and detail actions the parties will take to address climate change. The scope of which types of actions and the means of implementation to be included are yet to be determined.

The NAMA modality can provide the essential holistic framework to overhaul a complete sector when framed within the context of sustainable development and beyond pure mitigation aspects. The focus on the sustainability of the entire sector is essential for achieving lasting results. In this regard, UNDP's MDG-Carbon Programme has supported the development of this NAMA in order to help Namibia to achieve a transformative change and bring about rural development as long-term goal.

The Ministry of Environment and Tourism has been appointed as NAMA Approver to the UNFCCC and has been mandated to advance climate change activities in Namibia through its Directorate of Environmental Affairs. In a consultative process, it was thus agreed that the Ministry of Environment and Tourism shall act as the NAMA Coordinating Authority.

The outcomes of this NAMA with regards to Sustainable Development, 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 national development goals.

The NAMA design will provide the country with an accurate and credible information framework by applying a robust but simple MRV system for sustainable development impacts and GHG emission reductions. The calculation of GHG emission reductions are based on a CDM methodology while the MDG Carbon Sustainable Development Evaluation Tool will allow to quantify and monitor the sustainable development benefits.

This NAMA for Rural Development in Namibia through Electrification with Renewable Energies' is designed as an encouraging holistic framework that will help Namibia to move towards a low-carbon pathway while advancing long-term sustainable development benefits.

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Executive Summary

Access to modern energy services is a prerequisite for sustainable development. Namibia has made good progress in electrification, and major grid lines can be found in all provinces of the country. However, rural electrification is still at a low level and access to clean energy sources is limited. According to the Rural Electricity Distribution Master Plan (REDMP), 61 per cent of localities were without access to electricity in 2010.

There are three documents which set the scene for national development strategies in Namibia: Vision 2030; the Fourth National Development Plan (NDP4); and the Millennium Development Goals (MDG) Interim Report of 2013. Namibia's long-term development programmes and strategies to achieve its national objectives were set out in 2004 in the Vision 2030 strategy drafted by the National Planning Commission. NDP4 is the main policy and strategy document defining Namibia's national priorities, desired outcomes and strategic initiatives. The MDG Interim Report reviews progress in achieving the Millennium Development Goals, of which Goal 1 (on poverty and hunger), Goal 7 (on environmental sustainability) and Goal 8 (on global partnership for development) are of special importance.

The NAMA represents an opportunity for sustainable development for Namibia, and at the same time an opportunity for mitigation. The government can build on the existing policy framework, which targets the implementation of various policies, plans and actions aimed at mitigating GHG emissions while achieving sustainable development, so as to define a comprehensive and coherent NAMA development framework for Namibia.

The NAMA differs from traditional funding mechanisms which promote rural electrification and renewable energy projects. Interventions under the NAMA framework are prioritized in line with the socio-economic development objectives of the host country. The NAMA is designed with sustainable development benefits in mind and the design includes a focus on interventions which allow for income- generating activities which can create business opportunities for individuals, households and communities. The NAMA will spur the development of an environment which facilitates transformative change in the energy sector through an attractive regulatory and policy environment that incentivizes the private sector.

The overall target of the NAMA is to support Namibia in achieving the goal defined in the Off-Grid Energisation Master Plan (OGEMP), namely to provide access to appropriate energy technologies to everyone living or working in off-grid areas. More specifically, the NAMA aims at giving access to electricity for regions, households and companies which are currently without access to electricity, as well as improving the share of renewable energies (mainly using solar energy). The NAMA will reduce GHG emissions through the replacement of fossil fuels with renewable energies and will provide the conditions for income generation and new business opportunities. This will also lead to enhanced private sector involvement. Finally, the NAMA aims to achieve additional sustainable development benefits, such as better air quality and livelihoods for the poor.

The NAMA covers two interventions. Under Intervention A, mini grids will be established in rural communities. These mini grids will preferably be in the vicinity of schools and potential future tourism projects, such as eco-lodges. The mini grids will use renewable energy sources (solar, wind, hydro) and will provide electricity for lighting, radio and phone charging for households, for service and production activities in Rural Productivity Zones (RPZs),

and for lighting and the Internet for public buildings. The mini grids to be financed will be selected using the approach of "reversed auctioning". Under reversed auctioning, offers are accepted, starting from the cheapest, until the budget available for the specific auction is used up. In the case of the mini grids, auctioning will be based on value for money. Proposals will be ranked by their standing in the Value for Money Index (VMI), which will be calculated as "grant support requested (in N$) per one OGEMP Point Score".

Intervention B will support the installation of Energy Zones (EZs). Currently, so-called Energy Shops sell suitable, approved energy products and compatible appliances to consumers. Under Intervention B, these will be developed into the concept of Energy Zones, by adding a Rural Productivity Zone component.

In its first phase, the NAMA aims to establish 10 mini grids and 13 Energy Zones. This will provide electricity to around 1,400 households and around 8,500 people. Over the 15-year lifetime of the NAMA, emission reductions will reach around 20,000 tons of CO_2. Around 80 new enterprises will be established through these two interventions.

Capacity-building will be a key component in the implementation of the NAMA. Special emphasis will be given to identifying and supporting the development of income-generating activities in the Rural Productivity Zones (RPZs), as this is the key to positive rural development. Another important component will be technical support during the identification and implementation of the different projects under the two interventions, as the aim is to implement technically sound projects with low operating costs.

The baseline scenario for this NAMA consists of two components, a GHG baseline and a sustainable development (SD) baseline. Setting the baseline scenario in this way allows all effects to be properly assessed and quantified through the monitoring activities described in the Measurement, Reporting and Verification (MRV) system. In the MRV, the UN Framework Convention on Climate Change's (UNFCCC) "Small-scale Methodology: AMS-I.L.: Electrification of rural communities using renewable energy, Version 03.0" will be used to monitor GHG emission reductions.

Total costs of the NAMA are estimated at around US$14 million. This includes support to cover the investment costs of the two interventions as well as extensive capacity-building efforts. The Namibian Government is committed to providing around 30 per cent of the required funding, while the private sector is expected to contribute around 15 per cent. The remaining 55 per cent is expected to come from NAMA donors.

Implementation of the NAMA will be led by the Ministry of Environment as the NAMA Coordinating Authority (NCA). The Ministry of Environment has already been appointed as NAMA Approver/Focal Point to the UNFCCC and as the National Designated Authority (NDA) to the Green Climate Fund (GCF). The Environmental Investment Fund (EIF) will take on the role of NAMA Implementing Entity (NIE) and will be supported in technical issues by the Namibia Energy Institute (NEI). The Namibia Climate Change Committee (NCCC) will act as the supervisory board for the NAMA.

The two interventions of the NAMA will be implemented over a period of three and a half years, the NAMA will be supported by capacity building over a period of 5 year. Initial efforts will focus on securing national and international funding as well as establishing the institutional structure. Implementation of both interventions will take around three years and will be supported by extensive capacity-building efforts. After the implementation of the interventions, the NAMA will operate over a period of 15 years.

Abbreviations and Acronyms

BAP	Bali Action Plan
CDM	Clean Development Mechanism
CCSC	Climate Change Steering Committee
CO_2	Carbon Dioxide
COO	Community Owned and Operated
COP	Conference of Parties
CSO	Civil Society Organization
DNA	Designated National Authority
ECB	Electricity Control Board
EE	Energy efficiency
EIF	Environmental Investment Fund
EPC	Engineering Procurement and Construction
ES	Energy Shop
ESP	Energy Service Provider
EZ	Energy Zone
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GNI	Gross National Income
GPOBA	Global Partnership on Output-Based Aid
GS	Gold Standard
GWh	Gigawatt hour(s)
INDC	Intended Nationally Determined Contribution
IPP	Independent Power Producer
KAS	Konrad Adenauer Stiftung
kV	Kilovolt
KWh	Kilowatt hour(s)
KWp	Kilowatt peak
LCDS	Low Carbon Development Strategy
LDC	Least Developed Country
LEDS	Low Emissions Development Strategy
MD	Millennium Declaration
MDG	Millennium Development Goal
MDGR	Millennium Development Goals Report
MME	Ministry of Mines and Energy
MET	Ministry of Environment and Tourism
MoF	Ministry of Finance
MRV	Measurement, Reporting and Verification
MW	Megawatt
NA	NAMA Approver

NAMA	Nationally Appropriate Mitigation Action
NAMREP	Namibia Renewable Energy Programme
NC	National Communication
NCA	NAMA Coordinating Authority
NCCC	Namibia Climate Change Committee
NDA	National Designated Authority
NDP1	Namibia's First National Development Plan
NDP3	Namibia's Third National Development Plan
NDP4	Namibia's Fourth National Development Plan
NEE	NAMA Executing Entity
NEI	Namibia Energy Institute
NGO	Non-governmental organization
NIE	NAMA Implementing Entity
NIRP	National Integrated Resources Plan
NPC	National Planning Commission
NSI	Namibia Standards Institution
NTCRE	National Technical Committee on Renewable Energy
OGEMP	Off-Grid Energisation Master Plan
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PV	Photovoltaic
RE	Renewable Energy
RED	Regional Electricity Distributor
REDMP	Rural Electricity Distribution Master Plan
REEEI	Renewable Energy and Energy Efficiency Institute
RERA	Regional Electricity Regulators Association of Southern Africa
RPZ	Rural Productivity Zones
SADC	Southern African Development Community
SAPP	Southern African Power Pool
SD	Sustainable Development
SE4ALL	Sustainable Energy for All
SEIAN	Solar Energy Industries Association of Namibia
SET	Solar Energy Technologies
SME	Small and Medium-Sized Enterprise
SRF	Solar Revolving Fund
TWh	Terawatt hour(s)
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US$	US dollars
WASP	Water and Sanitation Policy
Wp	Watt peak capacity
WWF	World Wildlife Fund

1 Introduction

1.1 Rural Electrification and Development

Access to modern energy services is a prerequisite for sustainable development. Yet, as many as 1.3 billion people worldwide lack access to electricity. Between 2011 and 2013, the total number of people globally without access to electricity remained essentially unchanged (REN21, 2014). In many rural areas of developing countries, the costs of providing access to electricity are economically prohibitive and cannot be recovered within the economic lifetime of the electrification project.

The global initiative Sustainable Energy for All,[1] launched by the UN Secretary-General, Ban Ki-moon, in 2011, is encouraging the international development community in its efforts to improve energy access and thereby reduce energy poverty.

By increasing access to affordable lighting, communications and refrigeration, improved public health, and energy for productive activities, renewable energy systems offer an unprecedented opportunity to accelerate the expansion of energy access in remote and rural areas while at the same time contributing to the transition to modern energy services. Renewable energy can expand access to modern energy services in developing countries, both rapidly and cost effectively. As more attention turns to issues of energy access, as prices decline, and as new business models emerge, it is becoming apparent that rural energy markets in developing countries offer significant business opportunities, and products are being tailored specifically to meet the needs of these markets (REN21, 2014).

The impacts of access to adequate lighting, the means for food preservation (cooling) and information and communication technologies (ICTs) are significant. A study in Rwanda found that once grid electricity was available, four out of five households switched completely from traditional lighting sources (GTZ and SenterNovem, 2009). Money saved from switching from conventional (kerosene fueled) to solar lamps has been found to be commonly spent on better food, education and farming. Children were spending an average of an extra hour per night studying.

Food preservation is essential in hot climates, with cooling being the preferred conservation method. A study using data from five South American countries showed that refrigeration is a high priority for people of all income groups and a priority appliance for the poorest 20 per cent.

Information and communications technologies (ICTs), such as radio, televisions and computers, require electricity for their operation and can give people access to information (such as political activities, human rights, the market value of goods and produce, education, livelihoods options, etc.) (Practical Action, 2014).

At least as important as the impact of energy access on the quality of people's lives are the opportunities it creates for the world's poorest people to earn a living. There is a direct connection between energy access and poverty reduction based on the ability to earn a decent livelihood by using energy as a means of production. There are a variety of opportunities, ranging from having light to keep a shop open longer to providing cooling space in a freezer to running a pump to irrigate land.

1 See http://www.se4all.org.

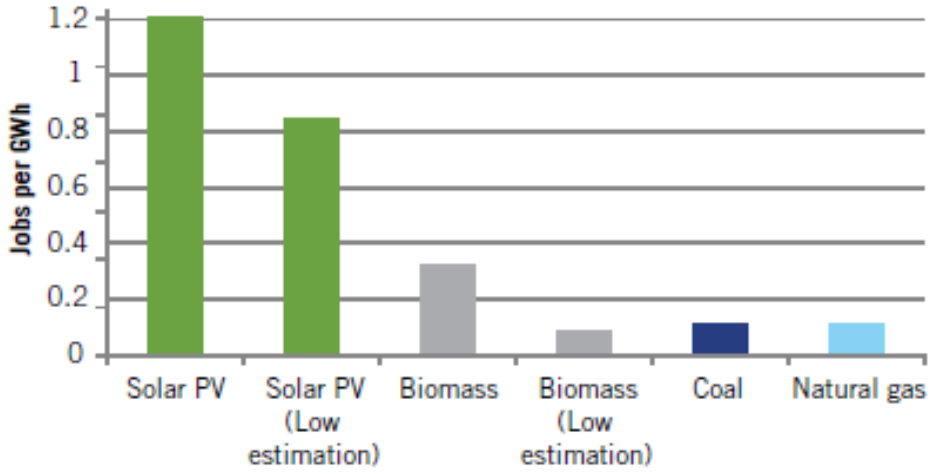
The Poor People's Energy Outlook (Practical Action, 2014) identifies four principal ways in which poor people earn a living, and all of those are affected by energy access:

- earning a living off the land;
- running small and medium-sized enterprises(SMEs);
- being employed; and
- earning by supplying energy to others.

Agriculture is one of the most significant contributors to the ability of poor people to earn a living and is one of the areas where energy can have the greatest impact by improving existing earnings. Energy plays a key role along the entire agricultural production chain, improving productivity, producing better-quality products, and earning more from adding value to produce. Improved agricultural processing and storage/cooling are energy services that expand incomes for farmers while creating employment in the SME sector. SMEs can lower costs, improve efficiency, broaden the services offered, and improve returns via more affordable, more reliable and higher quality energy supplies.

The supply of energy also represents an important employment sector with growth potential in and of itself. Increasing the number and quality of suppliers is an obvious prerequisite for successfully increasing access to energy supplies and services. The figure below shows the potential for job creation through investment in renewable energy technologies.

Figure 1. Estimated jobs created per GWh



Source: Practical Action, 2014

Renewable energy technologies often feature very low running costs, but high capital costs. Additionally, there are challenges of local-level maintenance, availability, and awareness of the technologies, which remain barriers to increased uptake. In order to increase rural renewable electrification it is essential to establish and strengthen institutional, financial, legal and regulatory support mechanisms for renewable energy deployment. In turn, these mechanisms can help by improving access to financing, developing the necessary infrastructure, and building awareness about renewable energy and the challenges posed by the lack of access to sustainable sources of energy. As sector-transforming instruments, Nationally Appropriate Mitigation Actions (NAMAs) have the potential to increase access to energy for rural populations in developing countries.

1.2 Nationally Appropriate Mitigation Actions (NAMAs)

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 to develop and implement NAMAs; NAMAs can help countries achieve their growth objectives and participate in the global climate change mitigation agenda. NAMAs help governments leverage national and international support to achieve appropriate, effective and transformational GHG mitigation and sustainable development targets for the country and within communities. COP 19 in 2013 saw the introduction of Intended Nationally Determined Contributions (INDCs), which were to be submitted by all parties, developed and developing, to the United Nations Framework Convention on Climate Change (UNFCCC) by the first quarter of 2015. The INDCs are for the period following 2020 and detail actions the parties will take to address climate change. The scope of which types of actions (e.g. mitigation, adaptation) and the means of implementation to be included are yet to be determined. The exact relationship of INDCs and NAMAs is thus also yet to be determined but both incorporate short-/medium-term goals, with NAMAs also acting as an implementation tool to translate short-/medium-term goals into action by outlining the means and vehicle/action plan to implement them (GIZ/UNEP, 2014).

In order to help clarify and assess parties' contributions, the document describing the decision to introduce INDCs identifies certain information that parties might provide, as appropriate, including "quantifiable information" on an INDC's timeframe, scope and coverage, and the assumptions and methodologies used in estimating and accounting for emissions. It also asks parties to say how their contributions are "fair and ambitious". NAMAs can be seen as a concrete pathway to achieving the agreed targets and can be incorporated as bottom-up contributions to the framework of INDCs.

1.2.1 NAMA as an Opportunity for Namibia

Even though NAMAs are often praised as an innovative instrument of climate policy, the basic concepts are well known and established in developed countries in the form of national climate and environmental policies. The new elements are their transformation to address the special needs and circumstances of developing countries, and the availability of international financial and technical support for their implementation from developed partners.

NAMAs can be seen as one of the most promising voluntary instruments for significantly reducing GHG emissions in developing countries that offer flexibility as to the interventions that can be employed. The objectives of a NAMA must go beyond its desired impact on GHG emission reductions to include the achievement of significant sustainable development goals that can benefit the country and its inhabitants as a whole.

It is evident that a NAMA represents a sustainable development opportunity for Namibia, and at the same time a mitigation opportunity. In fact, the Government can build on the existing policy framework, which targets the implementation of various policies, plans and actions aimed at mitigating GHG emissions while achieving sustainable development, so as to define a comprehensive and coherent NAMA development framework for Namibia.

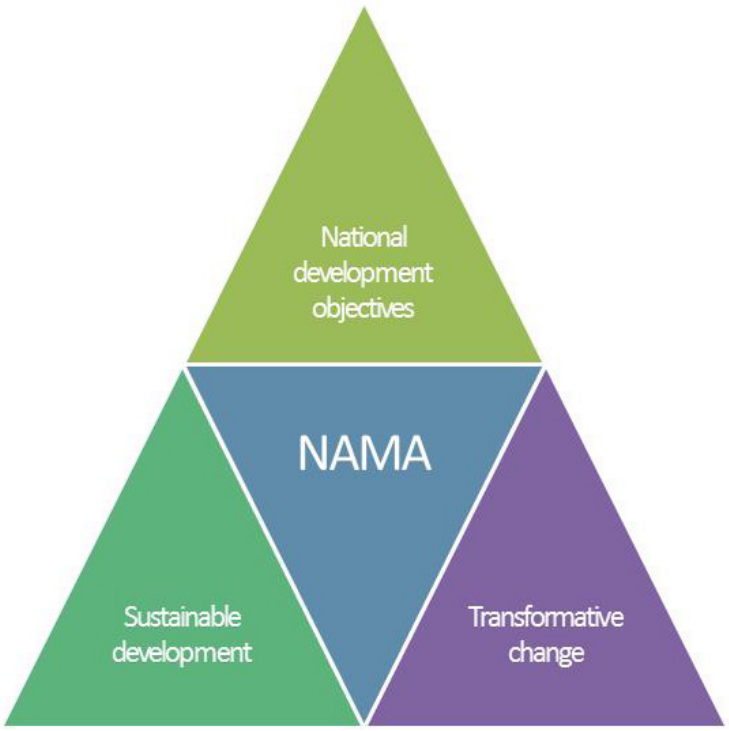
Namibia has made good progress in electrification and major grid lines can be found in all provinces of the country. However, rural electrification is still at a low level and access to clean energy sources is limited. A NAMA framework that promotes implementation of renewable energy interventions will address multiple issues facing the country. The proposed rural electrification NAMA will therefore identify renewable energy opportunities in Namibia that are expected to deliver the maximum substantial results in terms of energy access and sustainable development.

The NAMA differs from traditional funding mechanisms which promote rural electrification and renewable energy

projects because of three key components, summarized in Figure 2:

- Alignment with country objectives: The interventions under the NAMA framework are prioritized in line with the socio-economic development objectives of the host country.
- 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 that can create business opportunities for individuals, households and communities.
- Facilitates transformative change: The NAMA will spur the development of an environment which facilitates transformative change in the energy sector. An enticing 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 2. NAMA components



2 Background to Namibia

2.1 Geography and Administrative Divisions

The Republic of Namibia is a country in south-western Africa. Previously known as South West Africa, it is bordered by South Africa in the south, Angola and Zambia in the north, and Botswana and Zimbabwe in the east.

It is a vast, sparsely populated country situated along the south Atlantic coast of Africa between 17 and 29 degrees south of the Equator.

With a surface area of 824,292 km^2, Namibia is the 34th largest country in the world (GRN, 2015). It stretches for about 1,300 km from south to north and varies from 480 to 930 km in width from west to east. It is the second least densely populated country in the world, with 2.7 persons per km^2.

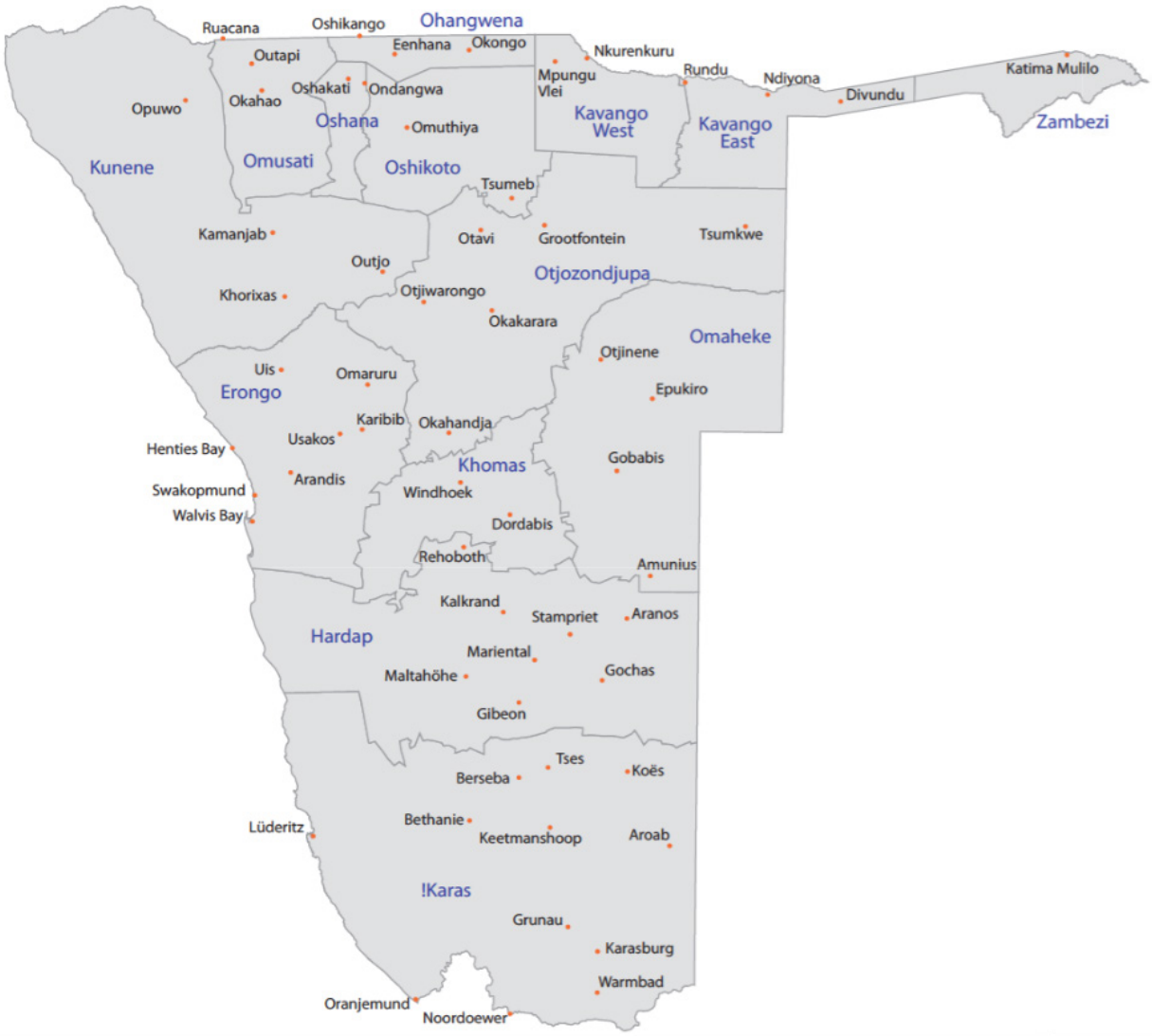
The capital of Namibia is Windhoek, located in the centre of the country. The highest administrative divisions are called regions[2], which are subdivided into constituencies (municipalities). There are 14 regions , as shown in Table 1.

Table 1. Areas and regions in Namibia

Area	Region
North	Omusati
	Oshana
	Ohangwena
	Oshikoto
North West	Kunene
North East	Kavango East
	Kavango West
	Zambezi (formerly Caprivi)
West	Erongo
Central	Otjozondjupa
	Omaheke
	Khomas
	Hardap
South	Karas

2 Namibia comprised 13 regions until 2013, when a 14th region was added through the division of the northern region of Kavango into Kavango East and Kavango West. Due to this relatively recent change, some data in this NAMA document are provided for the 13 regions that existed until 2013, reflecting what is available in the background documents.

Figure 3. Regions and major towns in Namibia



Source: NSA, 2013.

The Namibian landscape consists of five geographical areas, each with characteristic abiotic conditions and vegetation:

- the Central Plateau;
- the Namib Desert;
- the Escarpment;
- the Bushveld; and
- the Kalahari Desert.

The Namibian climate varies from arid and semi-arid to subtropical, with great differences of rainfall ranging from the dry south west to the tropical north east. Namibia has more than 300 days of sunshine per year. It is situated at the southern edge of the tropics; the Tropic of Capricorn cuts the country roughly in half.

2.2 The Economy

Namibia is classified as an upper middle income country by the World Bank, and ranks 87th out of 185 economies in terms of ease of doing business (World Bank, 2015b). The main economic activities by percentage contribution to GDP are (preliminary 2014 data) as set out in Table 3

Table 2. Main economic indicators, 2013

Indicator	Value
GDP (2013)(US$ billion)	13.11
GDP growth (2013) (%)	5.1
GDP per capita (2013) (US$)	5,693

Sour ce: World Bank, 2015a

Table 3. Sectoral contribution to GDP, 2014[a]

Industry	Percentage contribution to GDP
Primary industries	18.6
Agriculture and forestry	3.2
Fishing and fish processing on board	2.4
Mining and quarrying	13.0
Secondary industries	19.4
Manufacturing	13.3
Electricity and water	2.1
Construction	4.0
Tertiary industries	56.0
Wholesale and retail trade, repairs	11.2
Hotels and restaurants	1.6
Transport and communication	4.6
Financial intermediation	5.7
Real estate and business services	6.9
Community, social and personal service activities	1.9
Public administration and defence	11.9
Education	8.4
Health	3.1
Private households with employed persons	0.8

[a] Percentage contributions do not sum to 100 per cent in original source.

Source: NSA, 2015b.

- Agriculture is mostly based on livestock rearing, fishing and food processing. Cereals production meets only about half of domestic needs. Agriculture-based exports include fish, livestock, beef, beer and grapes.
- The mining industry, mainly precious stones (almost exclusively diamonds), base metals (zinc, copper, and lead), industrial minerals and uranium, contributed 13 per cent of GDP in 2014 (Table 2).
- A major contributor to the services sector is tourism. Most of the tourists are from Angola, South Africa and Europe. In 2011, Namibia recorded 1 million tourists for the first time.
- Export of goods and services represent 43 per cent of GDP (World Bank, 2015a). All major production sectors—mining, tourism, livestock and meat production, and fisheries—are export-oriented and are thus vulnerable to external trends. The major export destinations are South Africa, the UK, Angola, Belgium, Botswana and Canada.

2.3 Demography

Table 4. Main demographic indicators, 2011

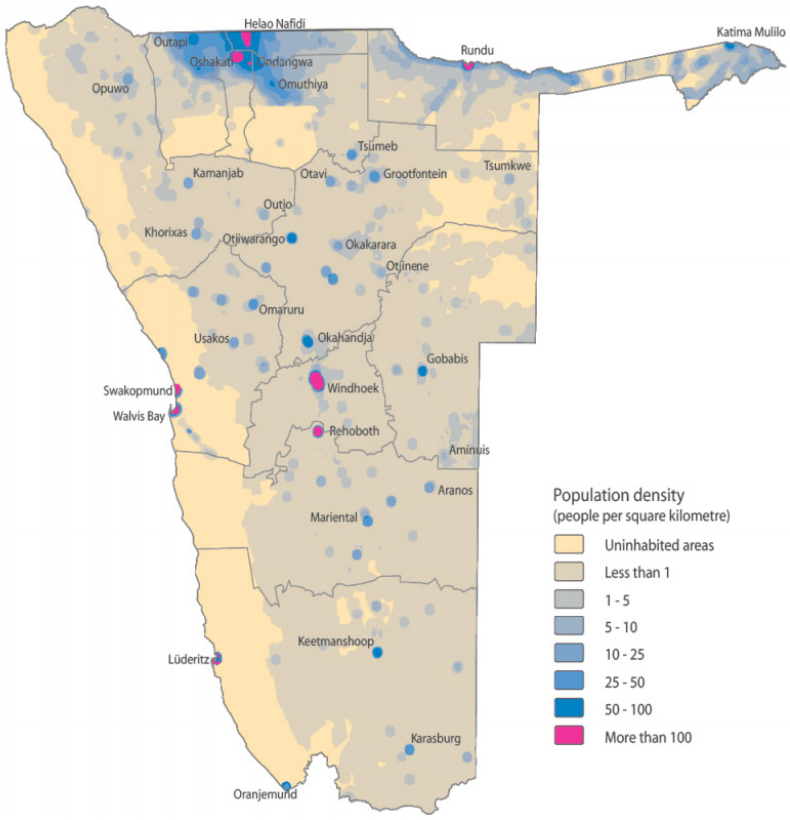
Population	2,113,077
Females	1,091,165
Males	1,021,912
Annual growth rate (%)	4
Population density	2.6 persons per km^2
Population in urban areas (%)	43
Population in rural areas (%)	57

Source: NSA, 2013.

Most of the rural population lives in the central-north, along the Okavango River and in Zambezi, due to favorable natural conditions (sufficient rainfall to grow staple crops). In other areas the rural population is distributed very sparsely in small villages and farms. The urban population is concentrated in the six largest towns.

The sparse distribution of the rural population has important consequences. The low population density combined with the sheer size of the country has an impact on infrastructure projects, not least by raising the investment costs of installing infrastructure in distant settlements.

Figure 4: Population density in Namibia



Source: NSA, 2013.

The population of the country has grown rapidly over recent decades, with growth in the urban areas being dramatically higher than in rural areas. Five of the country's six cities recorded more than 100 per cent increases in population between 1991 and 2011, the city of Oshakati's population rising by 293 per cent in this period (NSA, 2013).

2.4 Socio–Economic Conditions

Namibia has enjoyed considerable successes since it gained independence from South Africa in 1990 as a result of sound economic management, good governance, basic civic freedoms, and respect for human rights. Namibia inherited a well-functioning physical infrastructure, a market economy, rich natural resources, and a relatively strong public administration (NSA, 2013).

Although, as already noted, the World Bank classifies Namibia as an upper-middle income country, poverty incidence is still high—28.7 per cent of the population lived under the poverty line in 2009—despite having declined significantly during the past 20 years (69.3 per cent lived below the poverty line in 1994) (World Bank, 2015a).

The average per capita income figure is very misleading since Namibia's income distributions is among the most unequal in the world, the extreme social and economic inequalities reflecting a highly dualistic society (World Bank, 2009).

Table 5. Equality indicators

Indicator	Value (2009)
Gini index[3]	61.3
Income share held by highest 10 per cent	51.8
Income share held by lowest 10 per cent	1.5

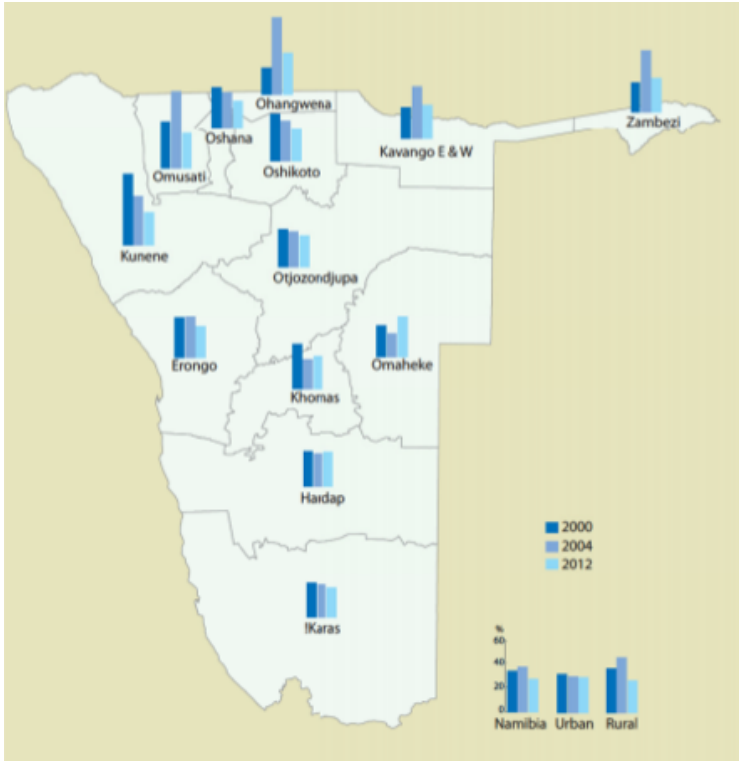
Source: World Bank, 2015a.

Regarding employment, the agriculture, forestry & fishing is the largest sector, accounting for 29.5 per cent of the employed population, followed by wholesale & retail trade with 13.6 per cent in 2013(NSA, 2015a).

Employment in the informal sector still remains high (41.1 per cent; NSA, 2015a).

Unemployment has remained extremely high for decades and was estimated at 28.1 per cent in 2014 (31.7 per cent for women, 24.3 per cent for men) (NSA, 2015a). About two thirds of unemployed people live in rural areas, where the unemployment rate was 30.2 per cent in 2014, compared with 26.2 per cent in urban areas (NSA, 2015a). The number of unemployed and discouraged workers in the younger population is large, particularly among women, which poses a risk for the country. In 2013 Namibia ranked 127th out of the 187 countries surveyed in the 2014 UNDP Human Development Report.

Figure 5. Unemployment in Namibia



Source: NSA, 2013.

3 The Gini index measures the extent to which the distribution of income or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.

The main source of income for more than 40 per cent of households is subsistence agriculture, a social grant, or other source outside of the formal sector.

2.5 National Development Strategies and Targets

There are three documents which set out national development strategies in Namibia: Vision 2030, the Fourth National Development Plan, and the Millennium Development Goals. These are described below.

2.5.1 Vision 2030

Namibia's long-term development programmes and strategies to achieve its national objectives were set out in 2004 in the Vision 2030 strategy drafted by the National Planning Commission (NPC, 2004 and GRN, 2015).

Vision 2030 focuses on seven themes to realize the country's long term vision:

- Inequality and social welfare;
- Human resources development and institutional capacity-building;
- Macroeconomic issues;
- Population, health and development;
- Namibia's natural resources sector;
- Knowledge, information and technology; and
- Factors of the external environment.

Vision 2030 is expected to reduce inequalities and move the nation significantly up the scale of human development. The Vision is also designed to promote the creation of a diversified, open market economy, with a resource-based industrial sector and commercial agriculture, placing great emphasis on skills development. The Vision will also promote competitiveness in the export sector, in terms of product quality and differentiation.

One of the major principles on which Vision 2030 is based is that of "partnerships", seen as a prerequisite for the achievement of dynamic, efficient and sustainable development. This involves partnership between government, communities and civil society, partnership between different branches of government, with the private sector, non-governmental organizations, community-based organizations and the international community, partnership between urban and rural societies and, ultimately between all members of Namibian society.

The driving forces for realizing the objectives of Vision 2030 are:

- education, science and technology;
- health and development;
- sustainable agriculture;
- peace and social justice; and
- gender equality.

By the year 2030, as Namibians commit themselves to the strategies of this Vision, they should belong to an industrial nation, enjoying abundant prosperity, interpersonal harmony, peace and political stability.

2.5.2 Namibia's Fourth National Development Plan (NDP4)

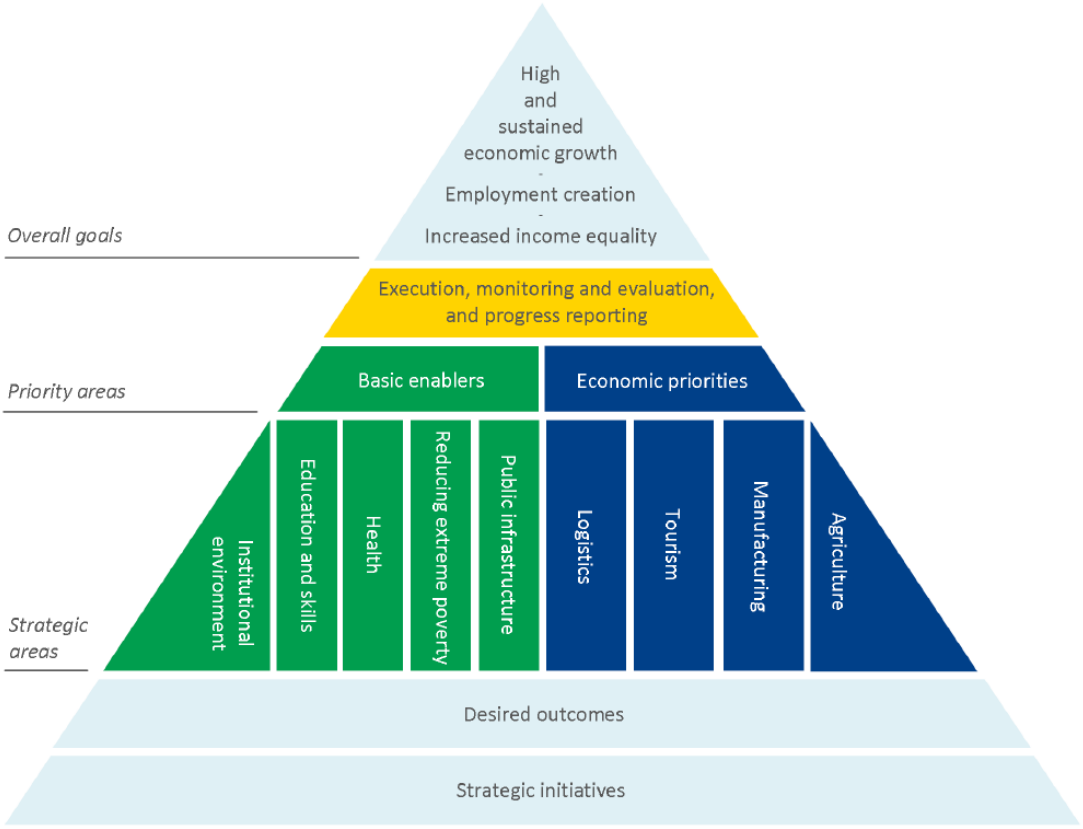
Since independence, the Namibian government has adopted planning as a management tool to help ensure effective decision-making. Planning is done through five-year development plans, beginning with the First National Development Plan (NDP1) for the period 1995/1996–2000/2001, the latest being Namibia's Fourth National Development Plan (NDP4).

NDP4 is the main policy and strategy document in Namibia defining national priorities, desired outcomes and strategic initiatives for the country. The NDP4 reviews the achievements under the previous plan (Namibia's Third National Development Plan – NDP3, valid from 2007/2008–2011/2012) and covers the period from 2012/2013 to 2016/2017 (NPC, 2012).

It is built upon the goals of Vision 2030, identifies challenges in all key sectors and provides direction on high-level national priorities, desired outcomes and strategic initiatives. The plan lists strategies for the main sectors (institutional environment, education and skills, health, extreme poverty, public infrastructure, logistics, tourism, manufacturing and agriculture).

The following figure shows the overall goals, priority areas and strategic areas.

Figure 6. Overall goals, priority areas and strategic areas in NDP4



Source: NPC, 2014.

The NDP4 has adopted three overarching goals:

- high and sustained economic growth;
- employment creation; and
- increased income equality.

In relation to energy, the NDP4 focuses on the big picture of energy supply in Namibia. Currently, Namibia imports the majority of its electricity from South Africa's electric utility, Eskom[4]. The NDP4 identifies the risk that a lack of sufficient and affordable energy could limit the economic development of the entire country. Therefore, "Desired Outcome 5.2" of the NDP4 sets the goal of having an adequate base load in place by 2017 to support industrial development. Electricity production capacity is planned to increase from the current 400 MW to more than 750 MW by 2017.

In addition to these investments in large-scale energy infrastructure, the plan also sees a role for renewable energies in Namibia's energy mix and sees the necessity of addressing the demand side by promoting electricity saving technologies (NPC, 2014, p. 75).

The government also recognizes the importance of infrastructure as a key to decrease poverty and to provide income generation opportunities, thereby reducing unemployment (NDP4, p. 16). Specific sectors have been identified in the plan as having the potential for growth and job creation, namely tourism, manufacturing and transport/logistics. These sectors also have significant multiplier effects on the economy, and therefore will stimulate growth and job creation in other sectors as well (NPC, 2014, p. 21).

Increasing the cooperation of public and private players is another focus of the NDP4, as Public Private Partnerships (PPPs) were seen as a means of accelerating growth and job creation. The Government committed itself to establishing an institutionalized public-private dialogue platform, which was expected not only to facilitate private sector participation, but also to support the efforts of the government to provide goods and services (NPC, 2014, p. 40).

The table below lists the challenges and strategies mentioned in NDP4 that are relevant to rural electrification.

Table 6. Challenges and strategies in NDP4 relevant to rural electrification

Challenge	Implication if challenge is not addressed	Strategy to address challenge
Institutional environment (p. 42)		
Limited public–private sector cooperation.	The lack of strong PPPs in the country will retard economic growth.	Establish an institutionalized public–private dialogue platform and hold frequent meetings through workshops, investment planning sessions and information briefings.
Poverty (p. 69)		
Unemployment in rural areas.	Households are prevented from escaping a life of extreme poverty due to a lack of income.	Cooperate with the private sector to identify and remove bottlenecks restricting private sector expansion. Improve infrastructure. Speed up land acquisition and development processes.

4 In 2012/2013 44 percent of electricity imports came from South Africa, 37 per cent from Zimbabwe and 18 per cent from Zambia (Nam-Power, 2014).

Challenge	Implication if challenge is not addressed	Strategy to address challenge
Public infrastructure (p. 79)		
Dependency on imported electricity continues.	Industry will be negatively affected by power shortages.	Establish base load capacity requirement and address the demand side during the NDP4 cycle.
Tourism (p. 95)		
Insufficient skills to run tourism activities.	The tourism industry is unable to grow sustainably.	Improve the availability of skills and training in tourism-related activities.

Source: NPC, 2012.

2.5.3 The Millennium Development Goals

The Namibia 2013 Millennium Development Goals Interim Progress Report (UNDP, 2013) is the fourth report on Namibia's progress towards achieving the MDGs to have been prepared since the Millennium Declaration (MD) was adopted by the then 189 member states of the United Nations at the Millennium Summit in New York in September 2000.

With regard to the tight relationship between energy access and development, as described above, the implementation of the following MDGs is relevant to rural electrification in Namibia:

- Goal 1: Eradicate extreme poverty and hunger;
- Goal 7: Ensure environmental sustainability; and
- Goal 8: Develop a global partnership for development.

2.5.3.1.1 Goal 1: Eradicate extreme poverty and hunger

Although Namibia has made great strides and achieved key milestones towards eradicating poverty and hunger, there are still challenges in terms of unemployment and employability, limited skilled and qualified human resources, limited research and development, food insecurity and malnutrition, and weak governance and mismanagement of funds (UNDP, 2013, p. 9).

Table 7. MDG 1 Status, 2013

Goals and indicators	Baseline	Status	Target (2015)	Target/Goal Achievable?
MDG:1 ERADICATE EXTREME POVERTY AND HUNGER				
Halve the proportion of individuals classified as poor (consumption expenditure on food and non-food items of N$377.96 per adult equivalent per month) (%)	69.3 (1993/94)	28.7 (2009/10)	34.7	Achieved
Halve the proportion of individuals classified as severely poor (consumption expenditure on food and non-food items of N$277.96 per adult equivalent per month) (%)	58.9 (1993/94)	15.3 (2009/10)	29.5	Achieved

Goals and indicators	Baseline	Status	Target (2015)	Target/Goal Achievable?
Gini coefficient	0.7 (2003/04)	0.5971 (2009/10)	0.5	Not on target
Halve the poverty gap ratio (%)-Poor	37.7 (1993/94)	8.8 (2009/10)	4.5%	Achieved
Halve the poverty gap ratio (%)-Severely Poor	28.1 (1993/94)	4.2 (2009/10)	4.5	Achieved
Employment to population ratio	43.1 (1997)	47.9 (2009/10)	—	No target set
Growth rate of GDP per person employed (N$)				No target set
Proportion of own account and contributing family workers in total employment (%)	7.7 (1997)	10.9		No target set
GDP growth (per annum; %)	3.6 (1993)	5 (2012)	6.3	Not on target
Double the share of poorest decile in national consumption (%)	1.07 (2003/04)	2.4 (2009/10)	5 (MDG+)	Not on target
Children under five stunted, as % of all children under five	28.4 (1992)	29 (2006/07)	14.2	Not on target

Source: NPC, 2013.

Key interventions needed to achieve the goals as identified in the interim progress report as requiring attention during the remaining period to the end of 2015 are:

- design of innovative ways to create employment;
- build Namibia's human capital;
- scale up a well-established social grant system;
- raise the budget allocation to education, health and food production programmes;
- speed up the processing of vital registration documents; and
- more effectively implement the Zero-Tolerance for Corruption strategy.

Goal 7: Ensure environmental sustainability

The targets for MDG 7 are to: integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss; by 2015 halve the proportion of people without sustainable access to safe drinking water and basic sanitation. Namibia has already achieved the targets in safe drinking water provision. Reaching the biological diversity protection targets in freehold land conservancy is not on track. However, the biggest gap is in achieving the basic sanitation target, mainly due to slow implementation of the Water and Sanitation Policy (WASP), a skills deficit, and insecure access to land and tenure.

Table 8. MDG 7 Status, 2013

Goals and indicators	Baseline	Status	Target (2015)	Target/Goal Achievable?
MDG 7: ENSURE ENVIRONMENTAL SUSTAINABILITY				
Areas protected to maintain biological diversity as percentage of all land (%)				
State protected areas	12.5 (1995)	18.3 (2011)	20.0	On track
Communal conservancies[a]	0.0 (1995)	19.4 (2013)	15.0	Achieved
Freehold land conservancies	5.0 (1990)	6.0 (2012)	10.0	Not on target
Community forests	0.0 (2003)	4.0 (2012)	5.0	On track
Proportion of households with access to safe drinking water (%)				
Urban	99 (2003)	99 (2010)	100	Considered as achieved
Rural	78 (2003)	90 (2010)	87	Achieved
Proportion of households with access to basic sanitation (%)				
Urban	59 (2003)	57 (2010)	98	Not on target
Rural	14 (2003)	17 (2010)	65	Not on target

[a] Conservancies are organisations dedicated to the conservation of wildlife and wildlife habitats.

Source: NPC, 2013.

Key interventions needed:

- speedy implementation of WASP;
- addressing the skills deficit for sanitation provision;
- ensuring secure access to land and security of tenure;
- rebuilding the pilchard ocean stock;
- seizing the opportunity to exploit Namibia's diverse wildlife and scenic landscape for tourism;
- ensuring environmentally sensitive extraction of natural resources;
- sustainably managing the demand for and use of Namibia's underground water resources; and
- pursuing implementation of incentives for the promotion of sustainable rangeland management and conservation farming.

Goal 8: Develop a global partnership for development

The interim progress report states: "The government continues to engage vigorously in regional and international economic cooperation and groupings for mutual benefit and strives to effect structural transformation towards sustainable economic growth and development. It also recognises that regionally integrated markets are crucial for small economies like Namibia's to be able to grow and develop in the face of intensified economic globalisation."

Namibia has reached the targets for MDG 8. However, there is still much room for improvement. The challenges identified are mainly in the capacity of the labour sector (lack of adequately skilled staff and labour inflexibility), accountability for improved public service delivery and elimination of corruption, ineffective public sector and civil society cooperation, and inadequate access to financing.

Table 9. MDG 8 Status, 2013

Goals and indicators	Baseline	Status	Target (2015)	Target/Goal Achievable?
MDG 8: DEVELOP A GLOBAL PARTNERSHIP FOR DEVELOPMENT				
Official development assistance to Namibia (US$ per capita)	89 (1990)	131 (2011)	90	Achieved
Internet users, percentage of population	15 (2010)	36 (2013)	20	Achieved
Cellphone subscribers, percentage of population	31 (2006)	115 (2013)	61	Achieved
Telephone lines, percentage of households	6.8 (2006)	8.1 (2013)	8	Achieved

Source: NPC, 2103.

Key interventions needed are:

- identification of critical skills shortages and consequently planning the development of these skills;
- strengthen institutional structures for public service performance and management accountability;
- making public key documents that would support the elimination of corruption and hold officials accountable for mismanagement of funds;
- government strengthening of the space for the private sector and CSOs to operate efficiently and in line with market forces;
- improved access to adequate financing; and
- provision of serviced land with tenure to ensure adequate collateral for the private sector to expand.

Table 10. Outstanding MDG targets and the barriers to achieving them

Goals and indicators	Barriers & challenges
Goal 1: Eradicate extreme poverty and hunger	
Gini coefficient	• Unemployment and employability • Limited skilled and qualified human resources • Food insecurity and malnutrition • Weak governance and mismanagement of funds
GDP growth (per annum)	
Double the share of poorest deciles in national consumption	
Children under five stunted, as % of all children under five	
Goal 7: Ensure environmental sustainability	
Freehold land conservancies	• Slow implementation of the Water and Sanitation Policy (WASP) • Skills deficit • Insecure access to land and tenure
Proportion of households with access to basic sanitation (%)- Urban	
Proportion of households with access to basic sanitation (%)- Rural	
Goal 8: Develop a global partnership for development	
	• Capacity of the labour sector (lack of adequately skilled staff and labour inflexibility) • Accountability for improved public service delivery and elimination of corruption • Ineffective public sector and civil society cooperation • Inadequate access to financing

3 Background to Rural Electrification in Namibia

3.1 Electricity Supply

The electricity demand through the national grid is supplied by domestic electric power plants (thermal and large-scale hydro) and imports from neighbouring countries.

Only around 41 per cent of Namibia's electricity demand is supplied by domestic power plants; the rest is covered by electricity imports from the Southern African Power Pool[5] (SAPP) member countries. SAPP is an interconnected system of electricity enterprises (national utilities) from the countries the Southern African Development Community (SADC)[6] that share generated power with each other. Namibia imports power mainly from South Africa, Zambia, and Zimbabwe (NamPower, 2014).

The majority of Namibia's local power generation is provided by four power plants (NamPower, 2014).

- The Ruacana Hydropower station on the Kunene river is the core of the Namibian power supply system. It is a run-of-river plant with capacity of 332 MW. However, due to being a run-of-river plant, the variations in Southern Angola's rainfall limit its performance. It is therefore operated as a base load plant during the rainy season (February-May) and as a peak plant for the rest of the year.
- The Van Eck (120 MW) coal-fired plant was built in 1973 in the outskirt of Windhoek. Its overall inefficiency and maintenance complications make it impossible to run the ageing plant at full capacity. In addition to its low efficiency, coal imports (via the port of Walvis Bay and transported by train to Windhoek) make the generation cost very high.
- Paratus (12 MW) is a peaking diesel power station commissioned in 1976.
- Anixas (23 MW) is a peaking diesel power station commissioned in November 2011.

Total installed generation capacity is therefore 487 MW. All four power plants are operated by the state-owned power utility NamPower.

The following power plant projects are in preparation:

- A natural gas-powered station in Kudu will be fuelled by gas extracted from the Orange Basin in the sea west of Oranjemund. The gas will be transported by pipeline to the 800 MW Kudu Power Station.
- A hydro power plant at Baynes on Kunene river, 200 km downstream of Ruacana, will have installed capacity of 600 MW. The power plant shall function as a mid-merit peaking station and the capacity should be equally shared by Namibia and Angola.[7]

3.2 Renewable Energy

In addition to the large Ruacana hydropower plant, there are several smaller renewable energy (RE) installations feeding into the grid. Despite the potential for RE sources, demonstrated by numerous analyses and studies, current utilization is rather low.

5 http://www.sapp.co.zw/.
6 http://www.sadc.int/.
7 http://www.nampower.com.na/Page.aspx?p=222.

Table 11. Installed renewable energy capacity in Namibia

RE source	Installed grid-connected capacity
Solar photovoltaics	64 kW
Biomass/biogas	250 kW
Wind	220 kW

Source: Data as cited in REEEI, 2014.

The Konrad Adenauer Stiftung´s study of renewables in Namibia's electricity sector (KAS, 2012) provides the following estimates of potential capacity and output from different renewable sources.

Table 12. Estimated increased capacity and production from selected renewables

	SOLAR PV	SOLAR WH	SOLAR CSP	WIND	BUSH-TO-ELECTRICITY
Approximate capacity addition/reduction	90 MW	100 MW	150 MW	100 MW	150 MW
Electrical energy produced / saved per year	160 GWh	530 GWh	850 GWh	193 GWh	920 GWh

Source: KAS, 2012.

This study also looks at additional benefits from using the various renewable energy sources.

Table 13. Qualitative comparisons of social, economic and environmental value created by different energy supply options

Technology→ ↓	COAL	SOLAR PV	SWH	SOLAR CSP	WIND	BUSH-TO-ELECTRICITY
Local job creation potential	low	medium	medium	low	low	high to very low
Local skilled workers	low	medium	medium	low	low	medium
Local unskilled workers	low	low	medium	low	low	high to very low
Broad-based income generation potential	low	medium	high	low	low	high to very low
Local capacity development potential	low	high	high	medium	medium	high to very low
Contribution to electricity supply/demand	very high	medium	high	high	medium	high
Cost savings per kWh generated/saved	medium	very low	very high	very low	medium	low to medium
Foreign exchange savings	very low	medium	high	medium	medium	medium to high
Carbon dioxide emissions	very high	very low	very low	very low	very low	medium

Technology→ ↓	COAL	SOLAR PV	SWH	SOLAR CSP	WIND	BUSH-TO-ELECTRICITY
PM, SO2 and NO2 emissions	high	very low	very low	very low	very low	medium
Water use	medium	very low	very low	medium	very low	medium
Total environmental footprint	very high	low	very low	medium	low	medium

Source: KAS, 2012.

Namibia has significant renewable energy potential. However, uptake and use of RE for mainstream electricity generation remain slow, as detailed below.

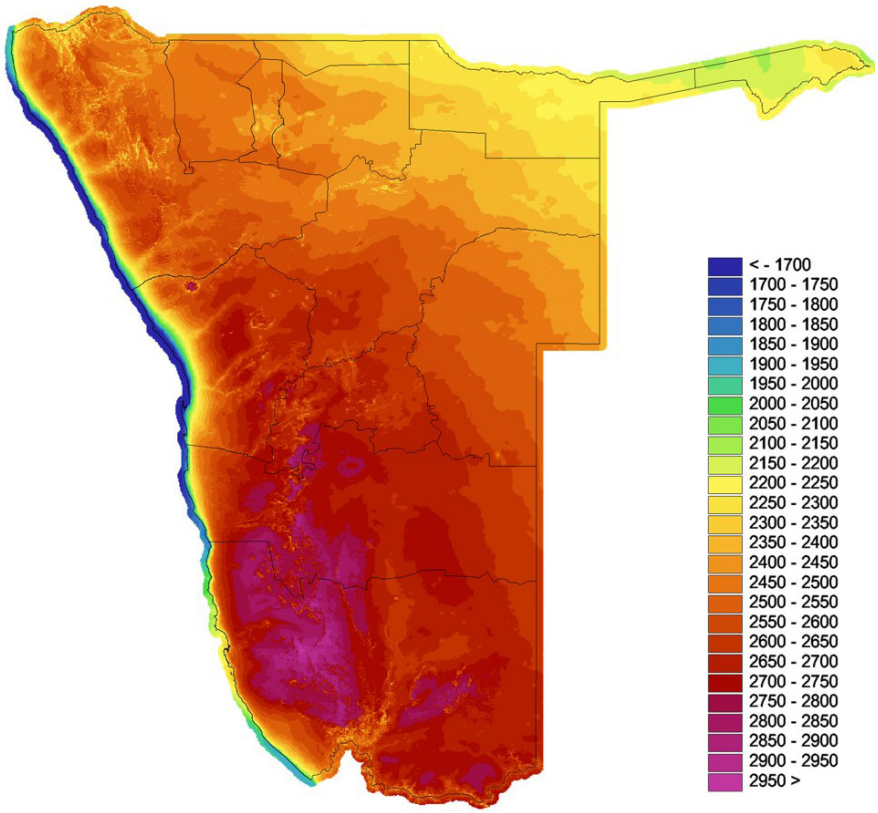
The general barriers to the grid-connected RE projects are:

- the often large distances to the national transmission system;
- the need to negotiate power purchase agreements with the state utility NamPower;
- the guarantees required by the Government for capital infrastructure projects;
- the need for generation licences from the Electricity Control Board (ECB).

Solar

Solar energy potential is the most abundant renewable energy source in Namibia. Namibia has an excellent sunshine regime, which produces annual energy yields of between 1,600 kWh/kWp in coastal areas and up to about 2,100 kWh/kWp in selected locations in southern Namibia, as shown on the solar irradiation map below

Figure 7. Long-term annual average of direct normal solar irradiance (kWh/m^2) in Namibia



Source: Gesto Energia S.A., 2012.

On average, a roof-mounted, grid-connected PV array with a capacity of one kWp will produce about 1,850 kWh of electrical energy per year. At an investment cost of between N$18/Wp and N$25/Wp in mid-2012, the total system would cost between N$25,000 and N$30,000. At a fixed interest rate of 12.5 per cent per year for a 20-year loan, the repayment for a system costing N$27,500 amounts to some N$3,800 per year, and results in a payback period of 5 years.

The following PV projects already exist in Namibia.

- A 64 kWp grid-connected rooftop PV on the NamPower building in Windhoek (NamPower 2013).
- Small PV plants with mini grids in Tsumkwe, Bam, Gobabeb (for details see section 3.8.2).
- PV technology is already used for numerous off-grid applications, providing electricity to farms, lodges, and off-grid homes and businesses, as well as for pumping water, especially in rural areas (often with battery or diesel back-up).

Table 14. Development of solar installations, 2004-2007

Technology	2004	2005	2006	2007
Photovoltaic electricity (kWp)	16.8	94.7	94.4	138.7
Solar water pumping (kWp))	36.7	25.0	95.9	180.2
Solar thermal (kWp))	356.0	641.6	2,017.6	4,312.8

Source: REEEI as cited in RERA, 2014.

There are a number of small grid-connected PV projects in preparation. Three of them—the 10 MW PV Gerus, the 10 MW PV Osana and the 10 MW PV Kokerbook—have been put out to tender by NamPower.

HYDRO

Namibia's hydro potential in Namibia is limited to a few rivers only. However, it should not be overlooked that the Ruacana power plant, the only grid-connected hydro power plant, supplies more than 80 per cent of Namibia´s power generation capacity (as described above).

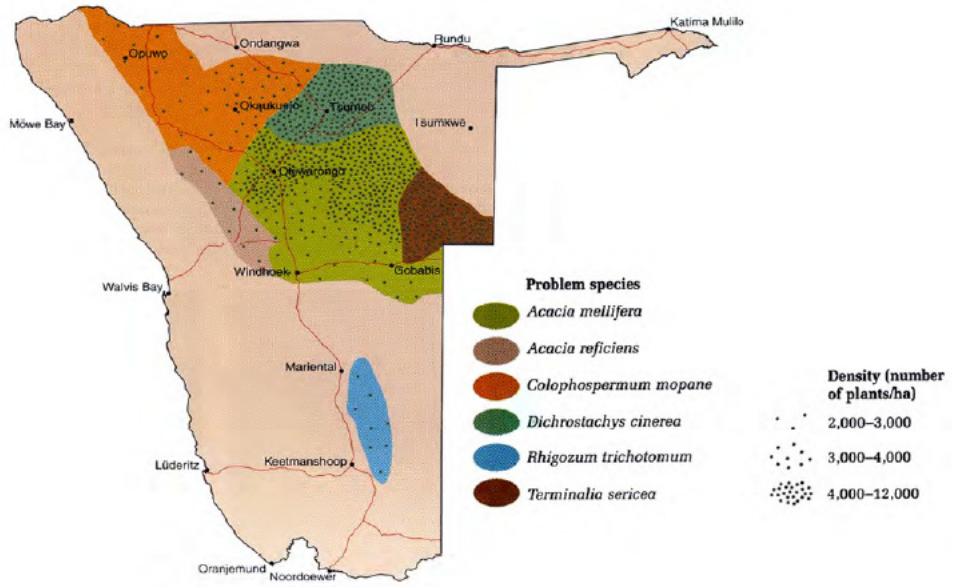
There is potential for a number of small-scale hydro power plants (with the capacity of each below 10 MW) on the lower Orange River in Namibia's south, and the Okavango River in the country's north-east. At least 120 MW could be realized if the identified potential throughout the country is developed, and could contribute some 0.3 TWh of green electricity per year (ECB, 2009).

The Baynes hydro-electricity scheme with storage dam, also on the Kunene River and downstream of Ruacana, (600 MW), is being planned by Nampower.

BIOMASS

Substantial areas in northern Namibia are covered by so-called invader bush. The energy content of Namibian invader bush broadly ranges between 4 and 6 kWh/kg (Hager, 2012 as cited in KAS, 2012). As well using invader bush for its energy content—in the form of wood logs, pellets, briquettes, wood chips or feedstock for combustion—it can also be a replacement for wood products in building materials and composite wood products, and as an additive in animal feeds.

Figure 8. Spatial distribution and bush densities



Source: KAS, 2012.

There are only a few projects using the energy of the invader bush, which is thus a substantially untapped but potentially sustainable resource, especially in rural areas.

The CBEND Project (Combating Bush Encroachment for Namibia's Development) has installed a 250 kW bush-to-electricity power plant on a commercial farm in the Otavi area, in one of the most bush infested areas of Namibia. The gasifier is fuelled with invader bush, and feeds electricity directly into the national grid. It is considered as a proof-of-concept project to determine the financial feasibility of this approach, assess the technical robustness of the technology, and establish Namibia's first independent power producer (DRFN, 2012).

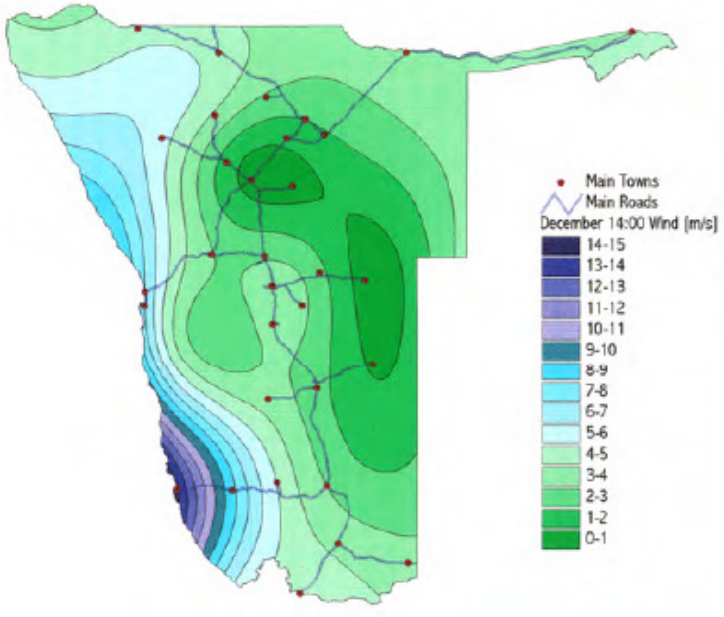
Other non-electricity projects and initiatives include (KAS, 2012):

- the use by the charcoal industry of invader bush (though not for electricity);
- the Cheetah Conservation Fund's "Bushblok" project uses invader bush to produce wood briquettes, which can replace fire wood; and
- energy for Future's proposed "Bush-to-Fuel Project" envisages providing wood chips for the Ohorongo Cement plant.

WIND

Wind resources in Namibia are considerable. Especially along the Namibian coast the conditions are very favourable for large-scale wind energy production, with wind speeds above 10 meters per second (KAS 2012), as shown in the figure below.

Figure 9. Indicative wind speeds in Namibia



Source: KAS, 2012.

The use of wind power is currently rather limited in Namibia. Small installations of several kilowatts for electricity production are a relatively recently introduced technology that is being utilized mainly by telecommunications companies to power their telecommunication towers.

Figure 10. Hybrid wind-solar system for telecommunication tower (3 kW wind + 48 V PV), installed in 2010

Source: Kestrel Renewable Energy, 2015.

There is only one large-scale installation: the Lüderitz wind park in Walvis Bay with one turbine and a capacity of 220 kW, which was erected in 2005, feeds the power grid operated the by regional provider ErongoRED (KAS, 2012).

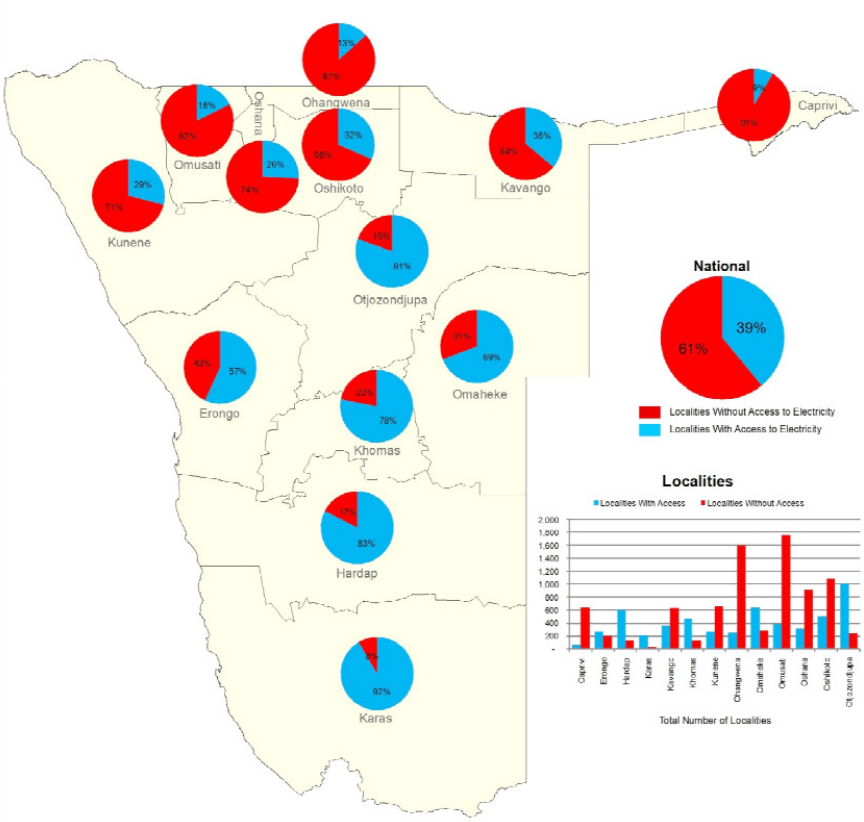
Other, non-electricity wind-based projects are the small/micro installations ("American-style" turbines) used for water pumping, which are very common in Namibia, especially on farms. This technology has been successfully used for decades and although the current trend is to replace it with solar energy sources, there are still about 30,000 wind water pumps installed in the country, the second highest number in Africa (MME 2006).

3.3 Electrification in Namibia

There is only limited information about the current scale of electrification in Namibia, since the figures refer to access to the main grid only. According to the Rural Electricity Distribution Master Plan (MME, 2010), 61 per cent of localities were without access to electricity in 2010, that is, only 39 per cent had access to electricity.

The following figure gives an overview on access to electricity by region.

Figure 11. Localities with and without access to electricity, 2010



Source: MME, 2010.

In terms of buildings in rural areas, the situation in electricity access is as follows (MME, 2012):

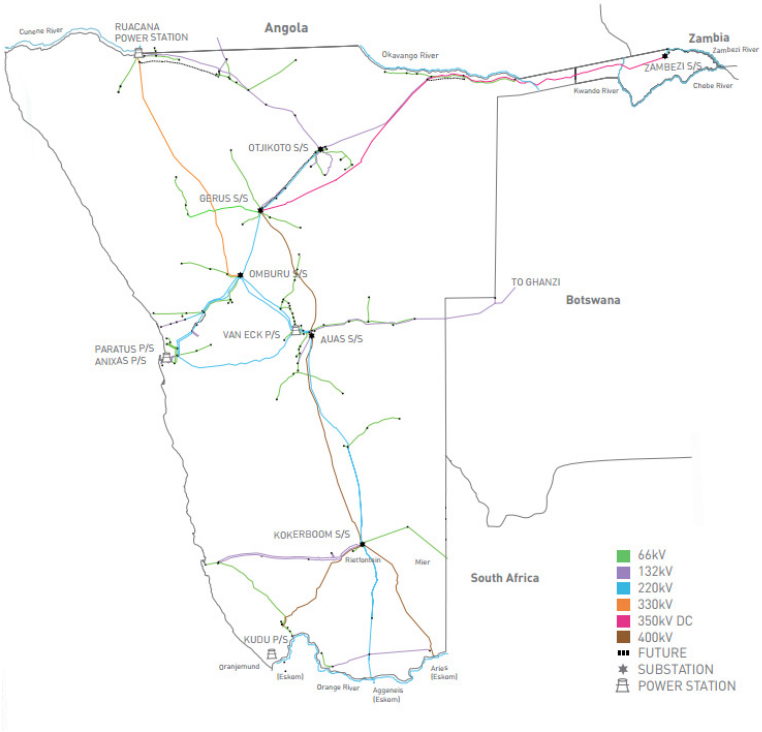
- only 16 per cent of rural households;
- 54 per cent of rural schools;
- 59 per cent of rural government buildings.

3.3.1 Electrification by the Main Grid

The Namibian transmission grid is operated by NamPower. The transmission grid has power lines with a voltage of between 132 kV and 400 kV and a length of around 25,000 km (NamPower, 2015).

The following figure shows the electricity grid in Namibia.

Figure 12. Namibia's electricity transmission grid



Source: NamPower, 2014.

3.3.2 Electrification by mini grids

Namibia has already gained experience in the installation and operation of mini grids, mostly based on renewable energies. There are three mini grids currently in operation, which are described in more detail below.

Tsumkwe Mini Grid (202 kWp PV)

Tsumkwe was identified in the Off-Grid Energisation Master Plan (OGEMP) as a potential location for a mini grid. The nearest grid was 500 km away, while Tsumkwe is relatively densely populated and generates demand for public services (the police, a hospital, telecommunications, a school. It was, therefore, well-suited as a location for a pilot mini grid. Also, there was already a diesel generator in operation, which provided power for a limited period of time per day, so there was basic demand for electricity.

Due to the sensitivity of the solar system to weather conditions and the diesel generator to the availability of diesel, two parallel distribution lines were installed to enable the separation of essential and non–essential loads, and interconnection to the main grid in the future. As a result, the cost of the distribution line was twice the anticipated cost.

Figure 13. Solar panels at Tsumkwe

Source: Juwi, 2013.

The system faces a number of problems.

- There is no full cost recovery system for the electricity consumed. It is important to note that consumers pay for the electricity through prepaid meters, for which they buy electricity credits at the local energy shop. If they have not paid, they will be automatically cut off. The tariff is however below the actual running cost of the plant, and the OTRC (Otjozondjupa Regional Council, the operator) continues to subsidize operations by supplying diesel for the back-up generators.
- High energy consumption in relation to installed capacity is a challenge and efforts to work on demand side management have not been successful.
- The PV panels that have been installed are not built to withstand the extreme temperatures and sandy conditions of the Namib desert.

Gobabeb Solar PV with Diesel Backup Mini Grid (26 kWp PV)

The Gobabeb Solar PV with Diesel Backup Mini Grid has a different background. It was built at the site of Nomabeb in the central Namib desert at Gobabeb by the Gobabeb Research and Training Centre (GRTC). GRTC was founded in 1962 as a SADC centre of excellence, to carry out scientific research into the interactions between the environment and human activities and to contribute to the sustainability of those interactions.

The mini grid has been constructed as part of the Demonstration Gobabeb Renewable Energy and Energy Efficiency (DEGREEE) project to demonstrate cost effective and environmentally sustainable solutions to remote energy supply at isolated locations far from the main power grid where grid extension is not an option. The project has been financed by the Denmark´s development cooperation, DANIDA, under the Danish Ministry of Foreign Affairs (GRTC, 2015).

DEGREEE implemented a complex system, including hybrid power generation, energy efficiency and energy saving utilities, an energy management system, an energy tariff structure, and an energy awareness programme,

that replaces two economically expensive and environmentally harmful diesel generators. The system provides electricity to the centre's buildings and offices, as well as housing for staff and visitors.

Figure 14. Solar panels at the Gobabeb Research and Training Centre

Source: GRTC, 2015.

Gam Solar PV Mini Grid (292 kWp PV)

The Ministry of Mines and Energy is currently implementing a mini grid at Gam village in the Tsumkwe Constituency, Otjozondjupa Region. The solar power plant will provide the whole of the Gam settlement, comprising about 1,630 people, with electricity.

Figure 15. Solar panels at Gam

Source: REEEI archive, 2015.

The following table summarizes the relevant information about the three mini grids.

Table 15. Key data on mini grids

	Gobabeb Solar PV with Diesel Backup Mini Grid	Tsumkwe Solar PV/Diesel Hybrid Mini Grid	Gam Solar PV Mini Grid
Installation year	2004	2011	2014
Installed capacity	26 kWp Solar PV/2x50 kVa diesel	202 kWp Solar PV/350 kVA diesel	292 kWp Solar PV
Technology	Solar PV, diesel	Solar PV, diesel	Solar PV, diesel
Batteries	420 kWh capacity	766 kWh capacity	
	2,600 kWh capacity		
No. of consumers connected	Research and training centre with 22 buildings, including offices, a library, laboratories,		
kitchens, conference facilities and housing	100 households, 20 different institutions and several small businesses (built on an existing mini grid operated by diesel; refurbishment of existing grid and grid extension)	1,630 people	
Investment costs	PV arrays: 1,1 mil NAD		
Batteries: 220,000 NAD			
Converter & controller: 440,000 NAD			
Two diesel generators: 165,000 NAD (in 1972)	US$2.8 million		
(US$1.8 million for equipment, US$1.0 million for capacity-building)	About N$22 million		
Financing	Own funds of Gobabeb Training and Research Center and donor money from Danida	75 per cent EU, 15 per cent NamPower, remainder from Ministry of Mines and Energy and	
Desert Research Foundation of Namibia	Ministry of Mines and Energy		
Operation time per day	24 hours	24 hours	24 hours
Operator	Gobabeb Center	Otjozondjupa Regional Council (OTRC)	Otjozondjupa Regional Council (OTRC)

Sources: RERA, 2014; Tsumkwe Energy, 2012; Hopsol, 2015.

Summary of the mini grids situation in Namibia

In 2013 the Regional Electricity Regulators Association of Southern Africa (RERA) initiated a regional project to create a framework for the development of mini grids in SADC region. The project consisted of developing regional regulation framework recommendations and two country case studies, one of them being focused on Namibia. The selection of Namibia was based on the strong expression of interest from the Government and the country's current plans to introduce policies and regulations to promote investment in renewable energy generation.

This interest is motivated by national power supply challenges, the high cost of conventional grid extension in a large but sparsely populated country and the recognition of the need to strengthen policy and regulatory environment for mini grid development (RERA, 2014).

The gaps identified, lessons learnt, and future activities required within the RERA project and from the implementation of the mini grids in Namibia to date are set out in Table 15.

Table 16. Conclusions on mini grids in Namibia

Conclusion	Gap identified/ Lessons learnt / Activities required
Technical feasibility of mini grids is demonstrated.	Namibia has implemented a 202 kWp PV minigrid at Tsumkwe in 2011, and a 292 kWp PV mini-grid at Gam in 2014.
Ownership, operation and maintenance roles need clarification and regulation.	Both NamPower and the REDs have been reluctant to take up the O&M of off-grid mini grids, citing lack of viability, relevant expertise, and regulatory uncertainty.
	Position of private sector is weak; rules for private O&M are missing.
Mini-grid planning and the development processes need clarification and regulation.	Norms, standards and codes of practice for performance, manufacturing, installation and maintenance of mini grids need to be updated and regularly reviewed.
	Capacity-building is needed.
	Guidance on mini grids should be prepared.
Funding sources are missing, financial sustainability is unclear.	The off-grid systems of public institutions and in remote villages are not financially sustainable, and tariffs so far have not been cost reflective. Transparent tariff determination methodologies needed to establish tariffs that cover operating and maintenance costs. Funding sources should be considered: • Once-off capital subsidies, which could be funded by levies on electricity sales, • The Solar Revolving Fund (SRF).

3.3.3 Stand-Alone and Off-Grid Electricity Solutions

In rural and remote areas where neither the main grid nor mini grids are available, the people depend on stand-alone electricity sources, mainly diesel generators. In recent years the usage of solar technologies has been increasing and hybrid solar/diesel systems have proved to be technically sound off grid solutions for people in areas far away from the national grid (RERA, 2014). The number of small individual solar power installations has also been increasing steadily (see Table 13, above).

4 Policy Environment

4.1 Regulatory Framework and Key Players for Rural Electrification

The following table lists the laws and regulations that are relevant to rural electrification.

Table 17. Regulatory framework relevant for rural electrification

Area	Policy/Law/ Regulation	Year	Description
COMPETENCY	Regional Councils Act (Act No. 22 of 1992) and Local Authority Councils Act (Act No. 23 of 1992)	1992	The legislative framework for institutionalizing decentralized government. Namibia's official decentralization policy identifies functions to be decentralized and lays down the implementation guidelines, resource strategies and the chosen form of decentralization. Regional councils have the power to supply electricity and gas.
	ElectricityAct (Act No. 2 of 2000)	2000	Established an independent regulator for the industry, the Electricity Control Board (ECB). A single-buyer market was established with the national utility NamPower being the single buyer. On the distribution side, Regional Electricity Distributors (REDs) were established to take over the distribution function from local authorities.
	Electricity Act (Act No. 4 of 2007)	2007	Repealed the Electricity Act of 2000, by providing for private participation in the sector. The act describes the requirements, conditions and obligations for obtaining licences to generate, trade in, transmit, distribute, import and export electricity.
ENERGY GENERATION & SUPPLY	Petroleum Products and Energy Amendment Act (Act No. 16 of 2003)	2003	Governs the Energy Fund and empowers the Minister responsible to impose a levy for the benefit of the fund on any energy source including electricity, nuclear and renewable energy.
	Draft Net Metering Rules	2013	Provides for the exchange of power and energy between a customer's generation facility (of capacity below 500 kW) and a distribution licencee's network.
ENVIRONMENT & CLIMATE CHANGE	Environmental Management Act (Act No. 7 of 2007)	2007	Provides for the sustainable management of natural resources and the protection of the environment in accordance with global commitments. Energy is a prescribed activity under the act. Thus it is mandatory for environment impact assessments to be undertaken for all energy projects. <is this correct? Looks like the minister has discretion as to whether EIAs for energy projects should be undertaken - see Section 27 (1) and (2) of the act.

Source: RERA, 2014.

Key stakeholders in rural electrification

The following public and private institutions are actively involved in the development and operation of the electricity sector in Namibia.

Public Sector Institutions

The Ministry of Mines and Energy (MME)[8]

The MME facilitates and regulates the development and sustainable utilization of Namibia's mineral and energy resources and is also responsible for rural electrification.

The Ministry of Environment and Tourism (MET)[9]

The MET has been mandated to advance climate change activities in Namibia through its Directorate of Environmental Affairs and is the NAMA focal point

The Ministry of Finance (MoF)[10]

The MoF provides funding for, e.g., the Environmental Investment Fund (EIF), which supports NGOs, SMEs and local governments.

The Environmental Investment Fund (EIF)[11]

The EIF was established by an act of parliament as a statutory entity outside the public service. The EIF runs a number of loan and grant schemes.

The National Planning Commission[12]

The NPC is responsible for planning national priorities and directing the course of national development and has a central role to play in ensuring that climate change considerations are properly reflected in sector plans and budgetary allocations.

The Electricity Control Board (ECB)[13]

The ECB established by the Electricity Act of 2000. Its role is to exercise control over the electricity supply industry and as such has responsibility for regulating electricity generation, transmission, distribution, supply, import and export in Namibia through setting tariffs and issuing licenses.

The National Technical Committee on Renewable Energy (NTCRE)

Headed by the National Standards Institute (NSI)[14], the NTCRE develops norms, standards and codes of practice for the performance, manufacture, installation and maintenance of renewable energy technologies. In 2006 it issued a Code of Practice and Register of Products and a list of approved technologies and suppliers.

NamPower[15]

NamPower is a state-owned enterprise that reports to the MME. It owns and operates most of the country's grid generation and all of the transmission assets as well as some distribution facilities in the rural areas of central and southern Namibia. As system operator and trader, NamPower has the important role of balancing supply and demand and is the contracting party for imports.

8 http://www.mme.gov.na/.
9 The link to the MET provided at the Namibian government webpage (www.gov.na) is www.met.gov.na. However, the link does not work.
10 http://www.mof.gov.na/.
11 http://www.eifnamibia.com/.
12 http://www.npc.gov.na.
13 http://www.ecb.org.na/.
14 http://www.nsi.com.na.
15 http://www.nampower.com.na/.

Regional Electricity Distributors (REDs)

REDs are state-owned legal entities tasked with the supply and distribution of electricity in a dedicated region. They comprise:

- NORED (covering the far northern part of the country);
- CENORED (covering the central-northern part of the country stretching to the Caprivi Strip comprising the Otjozondjupa and Kunene regions);
- ERONGORED (covering the central coastal region to the west of the country including Walvis Bay and Swakopmund);
- Central RED (not yet operational);
- Southern RED (not yet operational yet); and
- City of Windhoek (not a RED per se but retains all the functions of one)

The Renewable Energy and Energy Efficiency Institute (REEEI)[16]

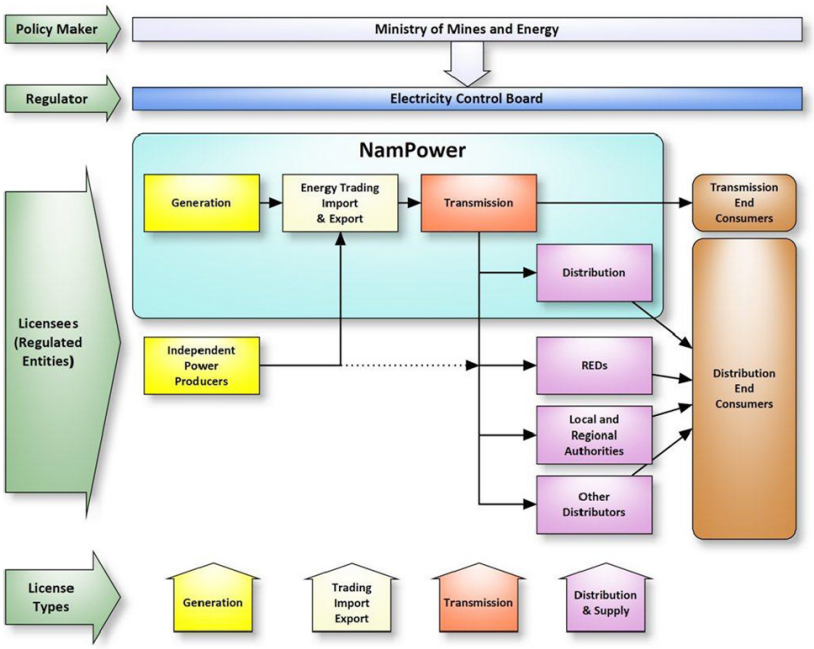
REEEI was established by the Government within the Polytechnic of Namibia in 2006. It is disseminating research and information about renewable energy as well as providing technical assistance to the MME in the implementation of renewable energy projects and programmes including addressing barriers to renewable energy development.

The Private Sector

There are about 50 solar technology companies, and at least three large-scale wind companies.[17] Private sector renewable energy companies are represented by their association, the Renewable Energy Industry Association of Namibia. The task of this national association is to represent the industry and to promote renewable energy.

The following figure gives an overview on the key players in the Namibian electricity sector.

Figure 16. Key players in the Namibian electricity sector



16 www.reeei.org.na/.
17 Interview with Solar Age Namibia, December 2014.

Source: Hatch, 2014.

4.2 National Strategies and Targets for Rural Electrification

The following table summarizes policies and programmes for rural electrification.

Table 18. Key policies and programmes relevant to rural electrification

Area	Policy/Programme	Description
DEVELOPMENT & POVERTY REDUCTION	Vision 2030	Vision 2030 envisages the transformation of Namibia into an industrialized nation with a viable natural resources based export sector.
	Namibia's Fourth National Development Plan (NDP4)	NDP4 is the main policy document defining Namibia's national priorities, desired outcomes, and strategic initiatives for the country in the period 2012/2013-2016/2017.
ENERGY GENERATION & SUPPLY	White Paper on Energy Policy	The energy policy is aimed at achieving security of supply, social development, effective governance, investment and growth, economic competitiveness, economic efficiency and sustainability. Although the country does not yet have a formal renewable energy policy, the White Paper of 1998 states the government's intention to use renewable energy technologies as on grid and off grid solutions for power facilities that provide basic services to the population, such as hospitals, schools and post offices. Specifically: *"Government will promote the use of economically viable renewable technologies, as a complement to grid electrification, to improve energy provision to rural areas. Government will ensure that funds made available for rural electrification will be allocated between grid and off-grid energy supply options, on the basis of their relative social and economic costs and benefits."*
	Rural Electricity Distribution Master Plan (REDMP), 2000	The REDMP was the guiding document for the rural electrification of the country through grid extension. It set time bound implementation targets.
	Rural Electricity Distribution Master Plan (REDMP) 2005	This master plan was an update of the 2000 plan. It defined areas for grid electrification as well as classifying areas outside these areas as off grid (grid extension not expected within 20 years), pre grid (grid extension not expected within 5-10 years) and grey (unclear areas or timing such as informal settlements or un-electrified households).
	Rural Electricity Distribution Master Plan (REDMP). National Overview Report 2010	This master plan was an update of the 2005 plan.

Area	Policy/Programme	Description
	Off-Grid Energisation Master Plan (OGEMP) 2007	To support the roll-out of renewable energy systems and rural electrification. The OGEMP assessed technologies appropriate for off-grid and mini grid generation according to the following three criteria: fuel and technologies which are already available in Namibia; fuels and technologies which address basic energy needs of households; technologies that require minimal operation and maintenance costs.
RESOURCES MANAGEMENT	National Integrated Resources Plan (NIRP) 2013	The NIRP is a 20 year electricity sector development plan. The NIRP focuses on electricity supply but also takes into account the possible impacts of other energy sources as well as potential demand side management programmes.

Rural Electricity Distribution Master Plan (REDMP)

The first Rural Electricity Distribution Master Plan (REDMP) was presented in the year 2000 and was the major document to drive rural electrification. The plan has been revised twice since, the latest version being published in 2010. The 2010 report consists of a National Overview Report and regional reports for the 13 regions of Namibia.

The master plan looks at the electrification of rural areas, which are defined in REDMP 2010 as "those communal areas that fall outside the proclaimed municipal areas and commercial farms". The REDMP has a 20-year horizon for electrification plan, classifying the electrification under the headings shown in Table 18.

Table 19: Classification of electrification areas

Classification	Electrification prospects
Grid	Localities scheduled for grid electrification in Years 1-5 of the master plan
Pre-grid	Localities scheduled for grid electrification in Years 6-20 of the master plan
Long term off-grid	Localities not scheduled for grid electrification within the span of the master plan
Grey areas	Locations where it is not clear how and if access to electricity will be provided

Source: MME, 2010.

Out of the 5,858 identified unelectrified rural settlements only 1,543 have been scheduled for electrification within the 20 years of REDMP implementation.

The following priorities for rural electrification are defined in the REDMP:

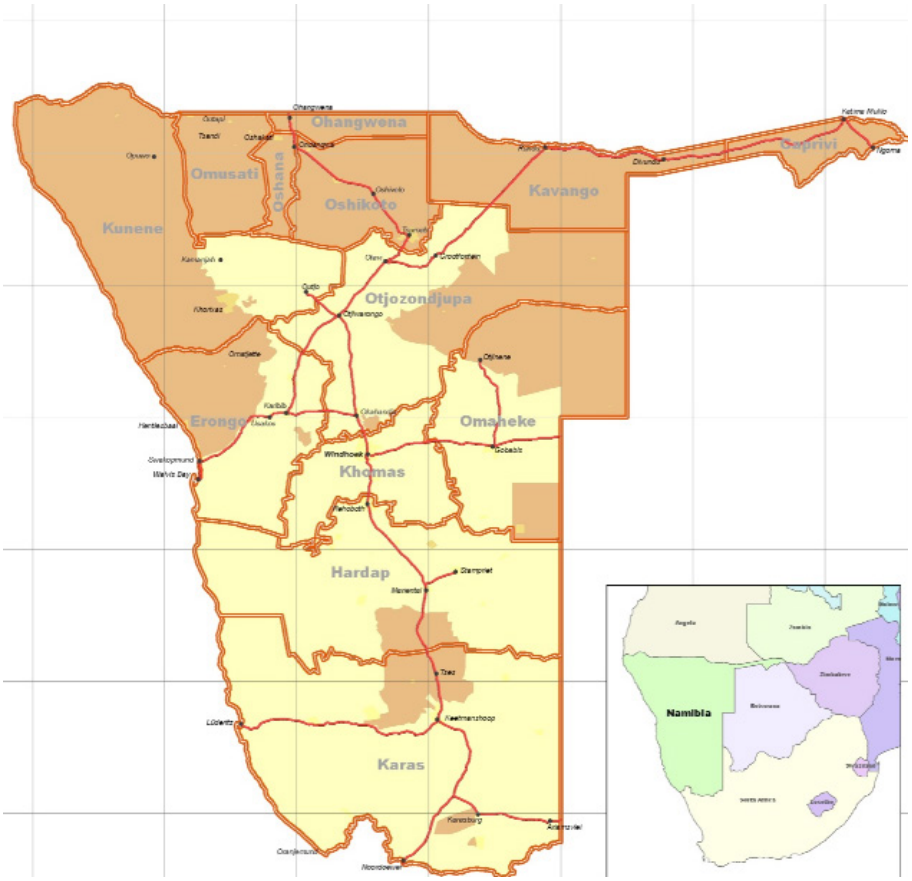
- government buildings, and especially schools, are to be prioritized within the REDMP;
- existing localities[18] are to be prioritized, to ensure that as far as technically possible, at least one locality per constituency is electrified per year for the next 20 years;

18 A locality is defined as any rural location (i.e. village) that has government buildings and where at least 10 or more homesteads fall within a 500 meter radius of a prospective transformer point. Any homestead within a 500 meter radius of a prospective transformer point also forms part of such a locality (MME, 2010, p. 33).

- the rural electrification programme for a specific region is to conclude if all identified existing localities within that region have been electrified; and
- off-grid localities are to be identified and listed, but will not be electrified as part of the REDMP.

The following map shows the areas covered by the REDMP.

Figure 17: Areas covered (brown) by the REDMP



Source: MME, 2010.

The REDMP identified potential locations for mini grids. In total, 27 localities with 17 schools are earmarked for off-grid electrification. The following table gives an overview of these localities.

Figure 18. Off-grid localities identified in the REDMP, 2010

Locality Name	Region	Constituency	No. of Schools	No. of Government buildings	No. of Homesteads	Distance from MV Grid [km]
Orumue	Kunene	Epupa	1	1		101
Onjuva	Kunene	Opuwo	1	1	4	133
Otjitanda	Kunene	Epupa	1	1	9	51
Otjinungwa	Kunene	Epupa	1	1	3	92
Okonjombo	Kunene	Opuwo	1	1	0	68
Puros	Kunene	Opuwo	1	1	33	82
Mangeti Duin	Otjozondjupa	Tsumkwe	1	1	143	121
Kukurushe	Otjozondjupa	Tsumkwe	1	1	15	115
MKata	Otjozondjupa	Tsumkwe	1	1	19	110
Asvoelnes	Otjozondjupa	Tsumkwe	1	1	16	159
//XA/Oba	Otjozondjupa	Tsumkwe	1	1	5	213
!Sawase	Otjozondjupa	Tsumkwe	1	1	4	231
Baraka	Otjozondjupa	Tsumkwe	1	1	14	234
Dorj/ui	Otjozondjupa	Tsumkwe	1	1	5	190
Nlaemjo	Otjozondjupa	Tsumkwe	1	1	4	189
//Auru	Otjozondjupa	Tsumkwe	1	1	12	220
Gam03	Otjozondjupa	Tsumkwe	1	1	26	240
Gam01	Otjozondjupa	Tsumkwe	-	-	23	239
Gam02	Otjozondjupa	Tsumkwe	-	-	115	239
Ombujomungondo	Omaheke	Epukiro	-	-	17	70
Ombujahamutue01	Omaheke	Epukiro	-	-	20	89
Ombujahamutue02	Omaheke	Epukiro	-	-	15	91
Otuindjo01	Omaheke	Epukiro	-	-	22	114
Otuindjo01	Omaheke	Epukiro	-	-	21	118
Ondjora	Omaheke	Epukiro	-	-	11	126
Otjeparu	Omaheke	Otjombinde	-	-	15	162
Dromvlei	Omaheke	Otjombinde	-	-	21	140
			17	17	592	

Source: REDMP, 2010.

Not covered by REDMP, but covered by the Off-Grid Electricity Master Plan (OGEMP), are municipal areas, off-grid areas and informal settlements around urban areas.

Off-Grid Energisation Master Plan for Namibia (OGEMP)

The Off-Grid Energisation Master Plan was developed in 2007 under the Namibian Renewable Energy Programme (NAMREP) and was financed by UNDP, GEF and the Namibian Ministry of Mines and Energy (UNDP 2007). The underlying objective of the OGEMP is to provide access to appropriate energy technologies in areas which are currently not connected to the electricity grid.

The Off-Grid Energisation Master Plan (OGEMP) uses specific definitions for rural electrification.

- Off-grid areas are those areas that, according to the REDMP, will not have access to electricity within 20 years.
- Pre-grid areas, as defined in the REDMP, are those areas that would not have access to electricity within five years. However, the OGEMP will only focus on providing access to pre-grid areas that would not have access to electricity within 10 years in the updated REDMP GIS database.
- Grey areas are locations where it is not clear in the 2005 REDMP how or if access to electricity will be provided.

There are three main tools designed for the electrification of the off-grid areas defined in the OGEMP:

- Electrification of rural public institutions;
- Energy Shops; and
- The Solar Revolving Fund.

Electrification of rural public institutions in off-grid areas using solar power was to reach all public institutions (including schools, churches and government buildings) in five years. This element of the plan has been pursued, and a sizeable number of rural institutions have received photovoltaic power. For instance, just in 2013, five schools in the Omusati and Omuthiya Regions received "containerized" PV systems, and four more were planned for 2014.

Energy Shops (ES) have been established within a reasonable distance of the targeted communities, in existing enterprises whose core business is mostly technically oriented (selling equipment, building materials, providing installation services, etc.).

Table 20. List of Energy Shops, 2014

	Energy Shop	Region	Core Business
1	Mariental Building Supplies	Hardap	Building materials
2	Andjamba Construction CC	Omusati	Construction
3	Together Electrical Services CC	Ohangwena	Electrical wiring and partly solar
4	Multiple Investments CC	Oshikoto	Engineering and investment
5	Natwe Electrical and Solar CC	Kavango West	Construction and electrical
6	Komeho Namibia Development Agency (NGO)/ Ben Hur Rural Development Centre (Centre is owned by GRN but managed by Komeho)	Omaheke	Energy (solar)
7	Communication Centre CC	Otjozondjupa	Multichoice agent (DSTV installation and payment collection)
8	Caprivi Cash & Carry CC	Zambezi	General dealer
9	Opuwo Building Supplies CC	Kunene	Construction and building, and materials supplier
10	Komeho Namibia Development Agency (NGO)/ Ongwediva Rural Development Centre (GRN) (Centre is owned by GRN and managed by Komeho)	Oshana	Rural Development Centre with focus on appropriate technology, hospitality, research and development, and marketing and sales
11	Alternative Energy Systems CC	Erongo	Alternative energy
12	Hoadati General Dealer (Sole Proprietor)	Erongo	General dealer
13	John's Auto Electric (Sole Proprietor)	Karas	Electrical and general spares

Source: Logos Consulting, 2014.

The planned aim of the Energy Shops was to:

- Make available suitable, approved and compatible energy technologies and appliances to households and businesses of all income levels. Energy Shops offer products such as dry cell batteries, 12V car batteries (for lighting purposes), LPG gas, energy efficient light bulbs (DC and AC), and fuel-efficient wood stoves. (OGEMP, p. 17)
- Serve as payment collection centres for the Solar Revolving Fund (described below) as well as assisting consumers to submit loan applications.
- Charge customers' 12V batteries for a standard fee

The OGEMP defined targets for the roll-out of the Energy Shops.

- Phase 1: In the first and the second year of the roll-out, one Energy Shop was to be established in each of the 13 provinces per year.
- Phase 2: Over a period of 20 years (up to 2027), it was planned to have a total of 156 energy shops established in Namibia.

The table below gives details on the roll-out plan.

Figure 19. Energy Shop roll-out plan

	Total Number of Off-Grid, Pre-Grid and Informal Settlement Households *	Number of New Energy Shops to be Established Each Year during the 20-Year Planning Period																				Total Energy Shops
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Regions																						
Caprivi	6,473	1	1				1				1					1						5
Erongo	3,686	1	1	1	1						1	1			3		1	2		1	2	15
Hardap	3,320	1	1						1	1	1	1	2	1					2	2		13
Karas	2,752	1	1				1							1		2	1	1	2		2	12
Kavango	13,627	1	1		2	1	1	2	1	2		3	1	1			1	1			1	19
Khomas	22,607	1	1																	2	1	5
Kunene	6,066	1	1		2	2	3		2	1	1		1	1	2	1			1	2		21
Ohangwena	11,113	1	1	3				1	1					1								8
Omaheke	5,118	1	1				1	1	1	2		1	1	2	1	1	1		1			15
Omusati	9,299	1	1	1		1		2		1		1	1			1		2			1	13
Oshana	7,372	1	1		1	1																4
Oshikoto	8,493	1	1	3	2	2					1						1					11
Otjozondjupa	6,628	1	1			1	1	1	1		2		1		1	1	2	1	1			15
National Total	*106,554*	*13*	*13*	*8*	*8*	*8*	*8*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*156*

Source: UNDP, 2007.

Between June 2011 and September 2012, 13 Energy Shops were launched in 12 regions, with one energy shop in each region, except for Erongo region, which has two. Three more shops were planned for launch before the end of 2014, but only one had been launched by December 2014.

An interim assessment of the roll-out, operation and performance of the first 13 Energy Shops, carried out by Logos

Consulting in February 2014, reached on the following conclusions.

- On Task 1 (selling energy technologies):
  - Most of the Energy Shops sell both RE and non-RE technologies. Solar energy solutions (solar water heaters, solar water pumps, solar home systems) are a large part of their portfolio.
  - The demand for renewable energy products varies regionally. In general the ES operators characterize demand from customers and their ability to pay as sufficient.
  - The shops have problems stocking a wide range of products due to lack of capital.
  - There is not a single supplier serving all the ESs, and in fact there is wide variety of suppliers of technologies used by the ES operators. Only one supplier serves more than three ESs. Most of the suppliers are Namibian companies. Most of the suppliers are not on the list of approved suppliers (see section on the support tools below for more details), and the ES operators are mostly not aware of the list.
  - Recording and data keeping of the stock sold is almost unknown. It is therefore not possible to estimate the share of approved technologies, the turnover of renewable and other energy technologies and the level of demand for them.
- On Task 2 (advising customers on applications for loans from the Solar Revolving Fund):
  - Very few Energy Shops have know-how about the fund and its application procedures.
  - At the same time, the SRF is slow to give feedback once applications have been submitted.
- On Task 3 (collecting payments from customers for the Solar Revolving Fund, including tracking down customers who fail to pay their loans and ensuring the payments are made):
  - This activity has not been implemented at all, even though the shops were supposed to be motivated by a financial incentive, and those shops which failed to carry out this activity were at risk of losing ES status.

The cost of the three-year pilot phase of implementation of the Energy Shops was estimated at N$7,603,000 (DRFN 2008), including the cost of short-term consultancy (N$1,085,000), and the annual funding for the implementing agency, the awareness campaign, the Solar Revolving Fund, and the equipment for the first 20 Level 1 Energy Shops (N$6,518,000).

The first phase of the project was supported financially by the MME and the Finnish Embassy's Local Cooperation Fund. Currently, there is no further funding for Energy Shops available. Private businesses wishing to become Energy Shops in the identified areas are encouraged to finance themselves, with the MME providing technical support display boards and publicity about the shop.

4.3 Financing and support instrumentss for Rural Electrification in Namibia

Rural electrification in Namibia is supported through the following instruments.

- Financing instruments: The Government of Namibia has established two funds, the Solar Revolving Fund (SRF) and the Environmental Investment Fund (EIF) to facilitate larger uptake of renewable energies in the country. Although their particular focus is not on rural areas and they also provide support for thermal energy technologies, they are important instruments for rural electrification.
- Support instruments: Within the NAMREP project, a register of solar technologies and a code of practice for the installation of these technologies have been elaborated in order to provide the basis for a pool of quality, reliable and durable technologies suitable for the Namibian climate.

The **Solar Revolving Fund**[19], administered by the Renewable Energy Division the MME, provides loans to households and communities for solar water heaters, solar water pumps and solar homes systems at a favourable interest rate of 5 per cent during the loan period of five years. The maximum loan amount is around US$2,600 for solar water heaters, between US$530 and US$3,100 for solar home systems and US$4,400 for solar water pumps.

Uptake of the loans has been high, and the fund has not been able to keep up with the demand. More than 1,000 systems of varying sizes have been installed through the SRF, and a repayment rate above 85 per cent has been reported.

The **Environmental Investment Fund**[20], under the Ministry of Environment and Tourism provides grants and subsidized loans, for acquiring a variety of renewable energy technologies, for lighting, pumping water and powering a range of household appliances, including solar water heaters.

The financing can be provided to civil society organizations, private sector and individuals from Namibia.

The **Register of Products for Namibian Solar Energy Technologies (ECB, 2006a)** has been elaborated in order to set a minimum standard for SET products, mainly those purchased through the Solar Revolving Fund facility. The criteria for the assessment of the products' suitability under Namibian conditions take account chiefly of their quality, reliability and life expectancy.

The main technologies and their components are:

- solar home systems (PV modules, batteries, charge controllers, lamps and inverters);
- PV water pumps (PV modules, electronic controllers and motor/pump subsets);and
- solar water heaters (Collector and storage Tanks).

The register was compiled on the basis of information available in April 2006. Administration and updating of the register are the responsibility of NAMREP.

The **Code of Practice for Namibian Solar Energy Technologies** (ECB, 2006a) covers all the activities around the site of an installation and is thus a practical field guide for solar technicians which is hands-on and accessible.

The code establishes standards for the three SET product groups as elaborated in the Register of Products—solar home systems, PV water pumps and solar water heaters.

The Code of Practice covers the following topics:

- safety guidelines;
- site assessment;
- installation;
- commissioning;
- maintenance; and
- handover to customer.

19 http://www.mme.gov.na/energy/solar.htm.
20 http://www.eifnamibia.com/.

4.4 Gap Analysis: policy gaps and recommendations

In order for a rural electrification NAMA to accomplish the transformative change which is integral to the success of the NAMA, a comprehensive and supportive regulatory and policy framework needs to be established. In order to establish this framework, the existing national documents must be assessed for gaps. Section 5.1 of this document introduced the policies and regulations. The following section will provide a brief summary of the policies most relevant to rural electrification in Namibia, address the gaps in those policies as they relate to the NAMA, and provide recommendations for supplementing these policies and regulations so that a supportive framework can be created.

4.4.1 Vision 2030

As already been described in detail in Section 3.5.1, Vision 2030 is Namibia's guide to development programmes and strategies which will facilitate the achievement of national objectives.

Gaps

Vision 2030 does not refer to energy access in its major strategies. Rural electrification is mentioned as a priority programme. However, in the actions to be taken under the sub-vision "Production Technology", there is no mention of the importance of off-grid rural electrification. Similarly, although the required actions under "Sustainable Development" do include increasing income generating activities, there is no mention of the off-grid rural electrification which will allow for many income generating activities to occur. The only place where rural electrification is mentioned as a key strategy is under the Biodiversity sub-vision. There it is stated that deforestation and loss of habitat through land degradation can be combated by providing rural communities with electricity and/or renewable energy sources (NPC, 2004). Though it is a significant area, the Biodiversity sub-vision is far from the only sub-vision for which rural electrification is important.

Recommendation

For rural electrification to be seen as an important item on the national agenda, it needs to be included as a key strategy for the Production Technology and Sustainable Development sub-visions in the next national development guiding framework.

4.4.2 Namibia's 4th National Development Plan 2012/2013-2016/2017

The NDP4 is the fourth of the seven development plans which will help Namibia to achieve the goals of Vision 2030.

Gaps

Importantly, NDP4 acknowledges that there is a "need to be more innovative in the funding mix of our public investments, including making greater use of PPP financing mechanisms, and with respect to the kind of infrastructure we provide, e.g. electricity connections off or via the national grid" (NPC, 2012). This is important in so far as it acknowledges the need for both off-grid electrification and private sector involvement. However, off-grid electrification is not explicitly mentioned in the desired outcome for electricity in NP4.

Recommendations

Due importance should be given in NDP5 to increasing off-grid rural electrification. This can be done by providing a clear target for the number of people who will be provided off-grid rural electrification during the plan. Furthermore, clear strategies to involve the private sector should be included.

4.4.3 The White Paper on Energy Policy 1998

The White Paper on the Energy Policy is a comprehensive document which discusses the challenges and opportunities posed by energy demand, energy supply and cross-cutting issues. The document includes sections which address the challenges and needs in the areas of renewable energy and rural electrification.

Gaps

The White Paper does not address a number of issues relevant to rural electrification. Currently the main method of providing electricity to off-grid communities is through the promotion of Energy Shops whose primary function is to sell renewable energy equipment, mainly for residential homes. The White Paper does not include any reference to Energy Shops.

One of the two main NAMA interventions builds on the idea of Energy Shops by creating Energy Zones. These zones will expand services beyond the sale of equipment to residents by providing off-grid energy services that promote economic activity.

The second main NAMA intervention proposes the establishment of mini grids. These mini grids would create opportunities for energy equipment to serve a number of homes, schools and/or businesses. The mini grids can be owned by an independent entity or a community, and the electricity can be purchased by users. The White Paper did not address the opportunities represented by mini grids.

Recommendation

The policy gaps in the White Paper can be addressed in one of two ways: either by updating it to address the above issues; or by writing a new White Paper focusing on Renewable Energy in Namibia. Updating the White Paper will require significantly expanding the document to include a section which focuses exclusively on off-grid electrification. This section will need to be aligned both with the concept of introducing energy zones and mini grids, as well as with the 2007 Off-Grid Energisation Master Plan for Namibia, which is the country's guiding document for off-grid electrification. A renewable energy White Paper will allow the national discussion on renewable energy and off-grid electrification to be brought to centre stage. Challenges and opportunities for renewable energy can be highlighted.

It is recommended that option 1, updating the White Paper on the Energy Policy of Namibia, be undertaken. The core reason for this recommendation is to ensure coherence of policy across the country's whole energy sector. Stakeholders in the fossil fuel and the renewable energy sub-sectors should discuss how the country can best meet its energy needs. The updated White Paper should include concrete targets for renewable energy and rural electrification, and should set out clearly those activities which must be implemented to accomplish these targets. Roles and responsibilities of the key actors should also be included.

4.4.4 The Local Authorities Act and Regional Councils Act and the ESI Restructuring Study

The Local Authorities Act and the Regional Councils Act, both of 1992, provide that Local and Regional Councils are authorized to supply electricity to residents. The councils also have the right to construct electricity infrastructure.

In the 1997 Electricity Supply Industry (ESI) Restructuring Study, it was decided that regional electricity distributors (REDs) will own and operate all distribution assets and provide electricity supply services to all customers within their distribution areas. The REDs are quasi-governmental private companies established under the terms of the Namibian Companies Act of 1973. Their owners (shareholders) are the stakeholders in electricity supply, mainly the Local and Regional Councils and and NamPower who transfer their assets and customers to the REDs in exchange for shares (ECB, n.d.). Cabinet approved the ESI recommendations in 2000. The REDs are owned by government shareholders.

Gaps

The Local Authorities Act, the Regional Councils Act and the approved ESI recommendations do not allow for the generation or distribution of electricity by the private sector other than the REDs, non-profit organizations or communities.

Recommendation

It is recommended that the Acts and approved ESI recommendations be altered to allow for licensing of the generation and distribution of electricity through renewable energy mini grids to any private sector companies, non-profit organizations or communities.

4.4.5 Off-Grid Energisation Master Plan (OGEMP) 2007

The OGEMP is the country's guiding document for off-grid electrification. It defines areas which will receive grid access in the shorter term (i.e. 5-10 years), those that will not receive access in the next 20 years and those areas for which it is not clear when access will be received. The OGEMP describes the Energy Shop approach, including which technologies will be sold in the shops, the cost of the shops and their planned roll-out as well as providing information about a revolving fund to facilitate access to credit. The OGEMP also allows for the establishment of the Solar Revolving Fund.

Gaps

The OGEMP document is an innovative document which highlights Namibia's needs for off-grid energization. The OGEMP sets clear priorities by defining pre-grid, off-grid and grey areas, as well as presenting concrete information about the Energy Shop approach roll-out. However, the scope of activities included in the OGEMP is extremely limited; it focuses exclusively on Energy Shops, thereby excluding other possibilities such as energy zones and mini grids.

The OGEMP also restricts the roles of key actors: the MME was to facilitate the establishment of Energy Shops through training, creation of promotional material, awareness raising and the provision of a PV system for 12V battery charging. The MME will provide funding for Energy Shops in selected areas only. The private sector is to establish the Energy Shops and residents should purchase the equipment using their own financing, with assistance from a MME-funded revolving fund. Therefore, the roles of the actors (the MME facilitators, the private sector owners and the public clients) and the location of the Energy Shops are both restricted.

Recommendations

The scope of the OGEMP should be expanded to include options for energization other than Energy Shops. The concept of Energy Zones, in which economic activities may take place, should be introduced. Provision should also be made for mini grids. Specification of the domestic costs of mini grids and the relevant regulations surrounding their establishment will facilitate involvement of actors such as REDs and the private sector. Finally, information on how the sustainability of the Solar Revolving Fund is to be ensured should be included in the OGEMP.

4.4.6 The Electricity Act 2007

The 2007 Electricity Act is the country's most recent Electricity Act; it supersedes the 2000 Electricity Act. The 2007 Act establishes the Electricity Control Board and lays out the country's regulatory framework for the electricity sector. The Electricity Act provides the framework for the provision of electricity by Local and Regional Councils.

Gaps

The Electricity Act contains only one brief mention of renewable energy, stating that "the Minister may make regulations in relation to installment and implementation of renewable energy technologies, the use thereof (including the placing of obligations on persons with regard thereto) and the provision of electricity therefrom" (GRN, 2007).

The Electricity Act gives authority to regional and local authorities to provide electricity. A Regional Council or a Local Authority Council must be licensed in accordance with Part IV and, once so licensed, these councils have full powers to provide electricity (GRN, 2007).

Recommendations

The Electricity Act should include special provisions for renewable energy. The Electricity Act should also lay out regulations for off-grid electricity generation and distribution. It should include provisions about the functioning of REDs. It should also allow for the expansion of the range of stakeholders who can distribute electricity in off-grid electrification and receive concessions; these stakeholders should include the private sector and non-profit organizations.

Similar to the recommendation for the Local and Regional Council Acts and the ESI restructuring, it is recommended that the private sector, non-profit organizations and communities should be eligible for licences to generate and distribute electricity through renewable energy mini grids.

4.4.7 Rural Electricity Distribution Master Plan for Namibia 2010

The Rural Electricity Distribution Master Plan (REDMP) 2010 is the most recent of version of the master plan defining those areas which are to undergo grid electrification as well as "off-grid localities", which are to undergo off-grid electrification and those localities which are very remote and therefore not likely to be connected to the grid in the next 20 years. The REDMP provides a priority list of 2,879 rural localities to be electrified in the next 20 years; the areas are prioritized based on a points score system. The REDMP also identifies 27 localities for off-grid electrification; the plan makes note that renewable energy sources that are integral to off-grid electrification.

Gaps

The REDMP does not have any major gaps in regards to off-grid electrification as it focuses on on-grid rural electrification and is complimented by the OGEMP which focuses on off-grid electrification. The REDMP is mentioned in this policy analysis because it defines off-grid localities and provides the methodology for prioritizing off-grid localities and the list of priority localities for off-grid electrification.

Recommendations

There are no specific recommendations relating to the REDMP.

4.4.8 Electricity Control Board guidance documents

The ECB has created a number of guidance documents for the electricity sector in Namibia. The documents include:

- The Code of Practice and Register of Products for Namibian Solar Energy Technologies (ECB 2006a);
- Development and Harmonisation of Licensee Distribution Electrical Infrastructure Technical Standards (ECB 2006b);
- The Grid Code (ECB 2006c);

- IPP and Investment Market Framework Technical Assistance (ECB 2006d); and
- Renewable Energy Feed-in Tariff Rules (ECB 2014).
- As previously mentioned, the Code of Practice and Register of Products for Namibian Solar Energy Technologies is an additional resource which is very useful in terms of rural electrification.

Gaps

Apart from the Code of Practice for Solar Energy Technologies, the ECB guidance is currently only applicable to activities relevant to the national electricity grid. There is therefore no guidance for off-grid electrification activities in terms of distribution infrastructure standards, grid codes, IPPs and feed-in tariffs.

Recommendations

It is recommended that the ECB should provide guidance regarding standards, codes and IPPs for off-grid rural electrification activities. This should include guidance on setting consumer tariffs for mini grids and Energy Zones. Additionally, the ECB should give guidance about what occurs, in terms of ownership and tariff structures, if the national grid reaches an area where a mini grid has been established.

4.4.9 Value Added Tax Act, No.10 of 2000

The 2000 Value Added Tax (VAT) Act and the 2002, 2007, 2008 and 2010 VAT Amendment Acts provide details about VAT in Namibia. VAT is applied to the supply of goods and services by taxable persons, as well as on the import of goods and services into Namibia. VAT is payable at the rate of 15 per cent of the value of the goods supplied or imported. Certain supplies are VAT exempt, including, for example, petrol, diesel and paraffin, as is the sale of land and buildings for residential purposes and the erection of residential buildings and public transport services (GRN 2002).

Gaps

Although the VAT law exempts fossil fuels, renewable energy equipment and renewable energy services do not benefit from such treatment. Neither does land for energy generation, transmission or distribution purposes.

Recommendations

Renewable energy technologies should be made tax exempt. All components of a renewable energy system (such as lights, meters, and diesel generators/batteries to be used as back-up) should also be tax exempt, as long as the importer can demonstrate that the components will be used in a renewable energy system. The Government of Namibia should negotiate with the other members of the Southern Africa Customs Union (SACU) to reduce or eliminate import duties on all RE technologies (MME 2005).

In addition to renewable energy technologies, renewable energy services, such as operation and maintenance services for renewable energy systems, should also be tax exempt.

4.4.10 Summary of policy recommendations

A summary table of the policy recommendations is presented below

Table 21. Summary of policy recommendations

Policy	Key recommendations
Vision 2030	Include renewable-energy-powered rural electrification as a key strategy under the sub-visions Production Technology and Sustainable Development.
NDP4	Provide a clear target for the number of people to be supplied through off-grid rural electrification. Provide clear strategies for private sector involvement.
White Paper on Energy Policy	Include concrete targets for renewable energy and rural electrification, as well as clear actions to be implemented to accomplish these targets. Include the roles and responsibilities of the key actors.
Local Authorities Act and Regional Councils Act & ESI Restructuring Study	Allow for licensing of the generation and distribution of electricity based on renewable energy mini grids to the private sector, non-profit organizations and communities.
Off-grid Energisation Master Plan	Expand its scope to include options for energization in addition to Energy Shops (i.e. Energy Zones and mini grids). Include concrete actions to be undertaken to ensure the sustainability of the Solar Revolving Fund.
Electricity Act	Include special provision for renewable energy and set out regulations for off-grid electricity generation and distribution. Include provisions about the functioning of REDs. Allow for the widening of the range of stakeholders who can distribute electricity through off-grid electrification.
Rural Electricity Distribution Master Plan	The REDMP addresses issues of rural electrification adequately.
Electricity Control Board guidance	Provide guidance regarding standards, codes and IPPs for off-grid rural electrification activities. This should include guidance on setting consumer tariffs for mini grids and Energy zones. Provide guidance about what occurs, in terms of ownership and tariff structures, if the national grid reaches an area where a mini grid has already been established.
Value Added Tax Act	Exempt renewable energy technologies and components from VAT, as well as diesel generators/batteries to be used as back-up for renewable energy powered systems. Negotiate with other members of SACU to reduce or eliminate import duties on all RE technologies. Exempt renewable energy services from taxes.
Local Authorities Act and Regional Councils Act and the ESI Restructuring Study	Permit the private sector, non-profit organizations or communities to obtain licences to generate and distribute electricity from renewable energy mini grids.

5 NAMA Targets and NAMA Baseline

5.1 NAMA Objectives and Targets

This rural electrification NAMA has been developed for the specific conditions and circumstances in Namibia, as described in the sections above. These characteristics may be summarized as follows.

- It is a vast country with large distances between settlements.
- Its population density is low, especially in rural areas.
- Poverty is high, again especially in rural areas.
- Its electricity sector is relatively immature, with restructuring still ongoing and regulations under development.
- The energy sector is dominated by government monopoly, and the level of privatization is low.
- Many institutions lack skills and capacities.

The NAMA objectives are designed to support Namibia in achieving its strategies for rural electrification and to complement ongoing activities in this field.

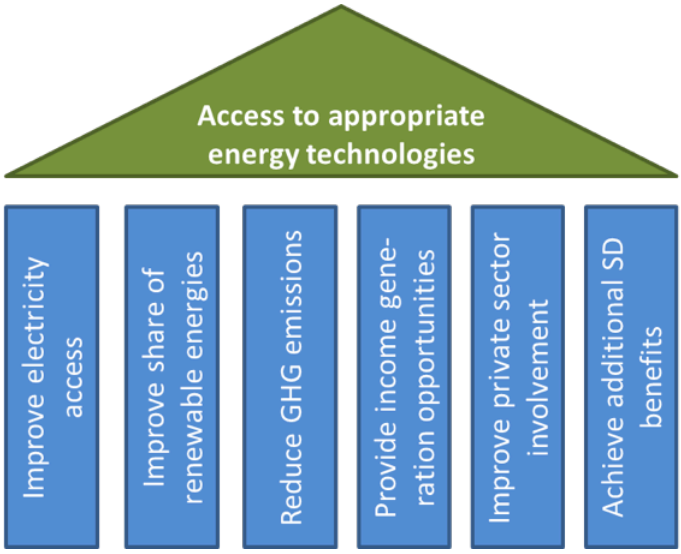
Therefore the overall target of the NAMA is to support Namibia in achieving the goal defined in the OEGMP: "To provide access to appropriate energy technologies to everyone living or working in off-grid, pre-grid and 'grey' areas."

More specifically, the NAMA aims at achieving the following objectives.

- **Improve electricity access:** the NAMA envisages the provision of electricity to regions, households and companies, which are currently without access to electricity.
- **Improve the share of renewable energies:** fossil fuels (e.g. kerosene/paraffin for lamps or diesel for diesel generators) will be replaced by electricity generated from renewable energy sources. Electricity will mainly be generated from solar energy and potentially also from wind and small hydro.
- **Reduce GHG emissions:** GHG emissions will be reduced through the replacement of fossil fuels with renewable energies (see section 6.3.2 for more details).
- **Provide conditions for income generation and new business opportunities:** a key element of the NAMA interventions will be to provide one of the basic preconditions for creation of income generating opportunities in rural areas—access to electricity—and will thus contribute to reducing poverty in these areas.
- **Increase private sector involvement:** the private sector is seen as an essential partner in the implementation of the NAMA – either through public-private partnership enterprises or in sub-contracting relationships with the public sector as technical consultants, technology suppliers, constructors, operators, etc. (see section 7 for more detail). Without the private sector and its commitment to provide co-funding and take risk, implementation of the interventions would be limited.
- **Achieve additional SD benefits:** the NAMA aims at contributing to SD benefits such as improvements to air quality and the livelihood of the poor (SD indicators are discussed in more detail in section 6.3.3).

The following figure summarizes the NAMA targets and objectives.

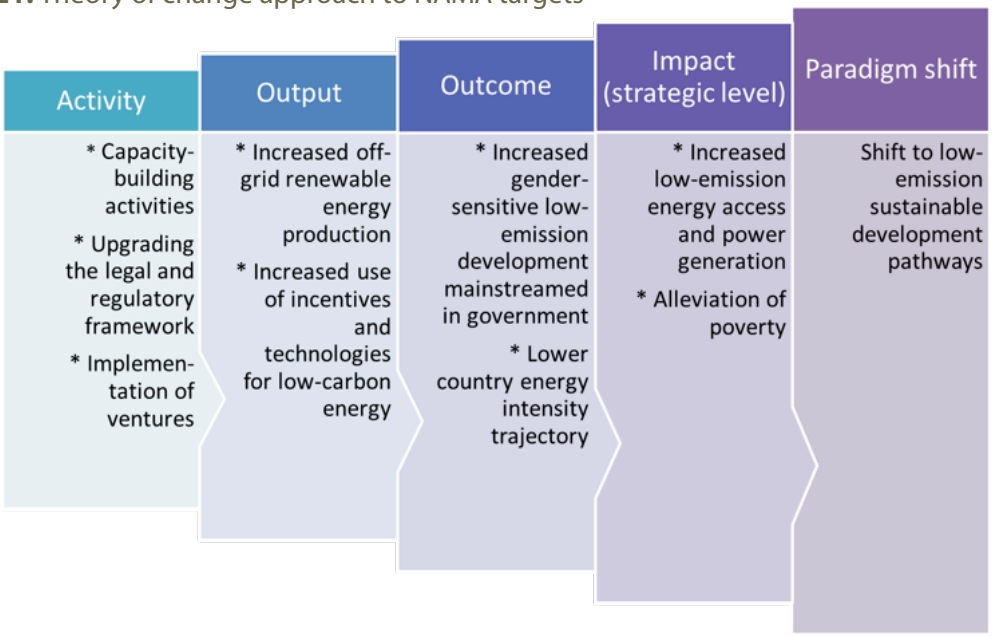
Figure 20. NAMA targets and objectives



5.2 Alignment of the NAMA objectives and targets with national strategies and 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 achieving sustainable development, national development goals and transformative change. This approach is also aligned with the Green Climate Fund (GCF) results framework. The overall targets for the NAMA can be seen in the following figure.

Figure 21. Theory of change approach to NAMA targets



The transformative change also must occur in a fashion which is aligned with national development goals.

The overarching objectives and targets of Namibia as a country are defined in the Vision 2030. According to this document, adopted in 2004, the target is to have "a prosperous and industralized Namibia, developed by her human resources, enjoying peace, harmony and political stability" by 2030 (NPC, 2004—Summary, p.15).

Vision 2030 does not offer much direction on energy or electrification. It does however include the target of achieving integrated urban and rural development in which there are opportunities for innovative and sustainable employment.

Table 22. Relationship of NAMA objectives to national strategies and targets for rural electrification

NAMA objective	National strategy & target
Improve electricity access	The section on public infrastructure in NDP4, states: "By 2017, Namibia will have in place adequate base load energy to support industry development through construction of energy infrastructure and the production capacity would have expanded from 400 to more than 750 MW to meet demand." Although the activities planned under the NAMA are not grid-related and therefore do not directly contribute to the achievement of this target, they will indirectly contribute to this target by offering a solution to the problem of supplying electricity to areas which cannot be reached by the electricity grid. Also, under this objective demand side management is addressed by promoting electricity-saving technologies. This is a key prerequisite for a successful implementation of mini grids. The OGEMP foresees electrification of rural public institutions with the aim of reaching all public institutions (including schools, churches and government buildings) within five years.
Improve the share of renewable energies	The OGEMP envisages: The roll-out of Energy Shops, creating one Energy Shop in each of the 13 provinces in each of the first two years of the plan and opening a total of 156 Energy Shops by 2027. Providing funding for households and communities through the Solar Revolving Fund.
Reduce GHG emissions	Since Namibia is a net sink in terms of GHG emissions, the country has no particular target for reducing emissions and in dealing with climate change focuses more on adaptation than mitigation measures. Nevertheless, Namibia is "committed to reducing its GHG emissions where this is financially and environmentally feasible" (MET, 2011, p.9).
Provide income generation and new business opportunities	The section of NDP4 on poverty states as a desired outcome that "by 2017, the proportion of severely poor individuals has dropped from 15.8 per cent in 2009/10 to below 10 per cent". As poverty is mainly a problem in rural areas, employment opportunities in rural areas are a key to achieving the poverty reduction target.
Improve private sector involvement	The section of NDP4 on the institutional environment states as a desired outcome that "by the year 2017, Namibia is the most competitive economy in the SADC region, according to the standards set by the World Economic Forum". The need to increase Public-Private Partnerships (PPPs) was identified as a key strategy for achieving this competitiveness. PPPs will also have an important role in establishing mini grids under the NAMA.
Achieve additional SD benefits	Additional SD benefits are only mentioned vaguely in the Vision 2030 and NDP4.

5.3 NAMA Baseline

The baseline is a current or an expected business-as-usual (BAU) scenario. Baselines are defined for the areas where the NAMA will have high positive impact, such as:

- Improved access to electricity in rural areas;
- GHG emissions reduction;
- Sustainable development; and
- Reduction of poverty and income generating activities.

5.3.1 Baseline of Rural Electrification Rate

According to the Rural Electricity Distribution Master Plan (MME, 2010), 61 per cent of localities were without access to electricity in 2010, meaning that only 39 per cent had electricity access.

In terms of settlements, out of the 5,858 identified unelectrified rural settlements only 1,543 have been scheduled for electrification within the 20 years of REDMP implementation.

The electricity supply in rural Namibia is facing three main issues:

- The geographic and demographic situation in Namibia makes electricity supply a challenge. The population density in the rural areas is extremely low. This presents serious challenges for supplying households, public buildings and businesses with electricity in a cost-efficient way, and thus excludes the traditional option of connecting to the grid in many remote areas.
- Rural off-grid electrification in the country has been developing slowly. Three mini grids have been constructed in the past 10 years, funded either by donors or the government.
- The financial situation of the rural population makes it difficult for them to pay for investment in electricity generation, and the population in off-grid areas has only limited access to electricity to meet their basic needs for radio, charging of mobile phones, etc.

It follows that the baseline, as a BAU scenario, envisages the continuation of the existing situation with only marginal improvements in grid connections and rural electrification.

5.3.2 Baseline of GHG Emissions

The baseline scenario must also take into consideration the issue of suppressed demand. To take account of suppressed demand the parties to the UNFCCC asked the Executive Board of the Clean Development Mechanism to explore the possibility of including in the baseline 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[21] to meet basic human needs[22] was unavailable to the end user of the service prior to the implementation of the project activity. Hence, these

21 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).

22 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 supplyand space heating), sanitation (waste treatment/disposal) and transportation.

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 Namibian situation, the application of suppressed demand translates into the baseline scenario assuming that all people's basic human needs are met through the use of the fossil fuel technologies previously mentioned.

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 tons of carbon dioxide per MWh (tCO_2/MWh);

b. For the facility consumption more than 55 kWh but equal to or less than 250 kWh, the baseline emission factor is 1.3 (tCO_2/MWh);

c. For the facility consumption beyond 250 kWh, the baseline emission factor is 1.0 (t CO_2/MWh.

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).

In light of the challenges for the NAMA actors of monitoring electricity generation per facility, a simplified and conservative baseline emission factor is chosen. For both interventions this will be 1.0 tCO_2/MWh.

5.3.3 Baseline of Socio-economic SD Indicators

As discussed in the introductory section 4.3, electrification is one of the preconditions for development, especially in rural areas, and brings many additional benefits besides the electricity itself. Thus, the NAMA will contribute to improvement of several aspects of so-called sustainable development indicators. Note that environment-related indicators (such as GHG emission reductions) are not included here.

Quantification of the baseline is in most of these cases more appropriately done on the local level, in particular in locations where the NAMA activities will take place. However, if the overall situation of the focus areas of the NAMA (remote, off-grid areas) is taken into consideration, it is assumed that the baseline for them is zero. Therefore the need for and impact of the NAMA activities are high.

Table 23. Indicators for SD baseline

Domain	Indicator
Environment	Climate change adaptation and mitigation. GHG emissions from combustion of the fossil fuels for electricity generation will be reduced/avoided.
Social	Improvement of health and healthcare conditions due to electrification of clinics and health centres. Improved livelihood of the poor/poverty alleviation through: • Enhanced productivity/efficiency arising from provision of electricity; • Creation of income-generating activities (jobs) and more business opportunities; • Reduction of expenditure on electricity (e.g. charging of phones).
Growth and Development	• Access to clean and sustainable energy, reduced use of fossil fuels (diesel and paraffin) and establishment of new sales points for RE & EE technology; • Education—improved learning conditions due to electrification of the schools.
Economic	• Creation of income-generating activities (enterprises); • Creation of jobs, for men and women.

As described in section 3.5.3, in Namibia there have been shortfalls in achieving some of the MDG goals. The selected SD indicators in the NAMA will support the achievement of the MDG goals. Goal 1 (eradicate extreme poverty and hunger) will be supported by providing new income generating activities in rural areas. As all NAMA interventions are based on renewable energies, Goal 7 (ensure environmental sustainability) will be massively supported. Finally, it is in the nature of a NAMA, where international donors are cooperating with national governments on development, that it supports Goal 8 (develop a global partnership for development).
One of the key pillars of rural development is the overall social and economic progress of rural society, and one way progress can be made is by encouraging rural entrepreneurship. An increase in rural businesses (services and products) can help tackle unemployment, improve access to services and increase average household income. For example, the generation of income-making opportunities through micro-enterprises can help women and rural youth to gain financial independence. The aim is to provide access to energy first and foremost to these micro enterprises to establish income generating activities involving the private sector, NGOs, development organizations, self-help groups and micro-credit initiatives – which in turn will help ensures the sustainability of the energy system. This in turn creates a situation where the overall economic progress of the community makes additional energy available for social initiatives (e.g. healthcare and education) and subsequently to households. The success of this model is based on the community's ability to generate sufficient income to pay for the energy consumed, which in turn ensures the operation and maintenance of the energy system.

5.3.4 Expected and targeted impacts of Intervention A – Mini grids

The values below are used for the estimation of the NAMA impacts in GHG emission reductions and reaching the SD indicators in the sections that follow. The values are for one implemented mini grid. The total impact of the NAMA Intervention A is the sum of all implemented mini grids.

Table 24. Assumed and targeted impact **of Intervention A**

Installed capacity	100 kWp
Proxy RE technology	Photovoltaic
Annual electricity production[a]	110,000 kWh
Annual GHG saving/avoidance	110 tons CO_2
Number of health care institutions (clinics) electrified	1
Number of households electrified	100
Number of people with access to RE electricity	600
Number of educational institutions (schools) electrified	1
Number of new income-generating activities (enterprises)	5
Number of new jobs (total)	2
Number of new jobs for women	1

[a] Estimated using IET, 2012.

5.3.5 Expected and targeted impacts of Intervention B – Energy Zones

The values below are used for the estimation of the NAMA impacts in GHG emission reductions and reaching the SD indicators in the sections that follow. The values are for one implemented Energy Zone. The total impact of the NAMA Intervention B is the sum of all implemented Energy Zones.

Table 25. Assumed and targeted impact of Intervention B

Installed capacity	10 kWp
Proxy RE technology	Photovoltaic
Annual electricity production[a]	18,000 kWh
Annual GHG saving/avoidance	18 ton CO_2
Number of health care institutions electrified	0
Number of educational institutions (schools) electrified	0
Number of households having access to electricity services	30
Number of people with access to RE electricity services	180
Number of new income-generating activities (enterprises)	2
Number of additional new women's enterprises	1
New sales points for RE&EE technologies	1

[a] Estimated using IET, 2012.

6 NAMA Interventions

The NAMA interventions were selected through a consultative process involving key Namibian stakeholders. During a workshop in September 2014, ideas on potential interventions were presented to these stakeholders. These ideas were based on strategic policy documents, such as the OGEMP and the REDMP. After discussion, two interventions were selected, the mini grids solution and Energy Zones. These interventions are described in the following pages.

6.1 NAMA Intervention A – Mini grids

6.1.1 Activities under Intervention A

Under Intervention A, mini grids will be established in rural communities. These mini grids will preferably be in the vicinity of schools and potential future tourism projects, such as eco-lodges. The mini grids will use renewable energy sources (solar, wind, hydro) and will provide the following services.

- Households: electricity for daily lighting (two lamps minimum), radio and phone charging will be provided.
- Rural Productivity Zones (RPZ): The mini grid will provide capacity for income generation opportunities for entrepreneurs and community projects (agro processing units, ice-making units, cooperative milling, sewing units, internet access, charging of phones, etc.).
- Public buildings: electricity for lighting and internet (schools, government buildings, health centres), computers/printers, mobile charger stations and basic clinic instruments in health centres).

Box 1. Rural Productivity Zones (RPZ)

The concept of the RPZ is based on the 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 lead to income enhancement and social development. The resulting economic activities generate money, which in part goes into paying for the investment, and the operation and maintenance of the energy system and infrastructure. In this manner RPZs increase the ability of consumers to make consumer payments, by allowing for more community level income generation. In addition to economic activities RPZs may also provide 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, 2014b).

6.1.2 Eligibility criteria

In order to be able to receive funding under the NAMA, any mini grid needs to meet the following eligibility criteria.

Table 26. Eligibility criteria, Intervention A

Eligibility criterion	Description
Location	Any off-grid area as defined in the REDMP (MME, 2010, p. 40) is eligible. Locations in pre-grid or grey areas are not eligible. The mini grid must be at least 10 km away from the nearest power line. The 27 potential localities earmarked in the REDMP (MME, 2010, p. 162) are eligible.
Technology[23]	Energy supply: the mini grid will be operated with solar PV or a combination of solar PV and wind power.
	Battery: batteries are recommended for a steady electricity supply.
	Backup: fossil-fuel back-up systems are allowed; however, the share of electricity from renewable energies must be at least 75 per cent.
Connections	The mini grid must connect a minimum of 20 households.
Service level	Dwellers: the minimum service level provided to dwellers needs to include at least two sources of lighting, radio and phone charging.
	Income generating activities: the mini-grid must include opportunities for income generating activities. The following types of activities are recommended to be included: • Agro processing units • Ice-making units • Cooperative milling • Solar cooker production • Bakeries • Internet access • Charging of phones. Activities will be considered via the Point Score System (for details on the Point Score System, see Table 25).
	The mini grid must provide electricity 24 hours per day.
Point Score	A project must reach a total Point Score of at least 200 (see details on Point Score System in Table 25). The sub-score for income generating activities must be at least 80.
Implementation	Mini grids must be operational within 18 months of contract award.
Funding	Maximum grant funding is 80 per cent of total investment costs. Operating costs must be covered from income from electricity sales.

23 Other reneweble energy technologies such as biomass, biogas and hydro power are eligible but must be cost competitive.

The method, which will be applied to select the mini grids is "reversed auctioning" (see Box 2). Under reversed auctioning, offers are accepted – starting from the cheapest offer – until the budget available for the specific auction is used up. In the case of the mini grids, auctioning will be based on value for money. Proposals will be ranked by their Value for Money Index (VMI), which will be calculated as "grant support requested (in N$) per one OGEMP Point Score".

Box 2. Reverse Auctioning

Reverse auctioning had its origin in the 1990s and is now commonly used by governments when tendering support schemes for renewable energies.

In a reverse auctioning system, proposals are collected based on tendering/eligibility criteria.

These proposals are reviewed, evaluated and ranked according to the tendering criteria (e.g. electricity generation price in US$/kWh or grant support requested in US$/kW peak).

Examples are the Renewable Auction Mechanism of the California Public Utility Commission or the Solar Auction of the Australian Capital Territory (Wikipedia, 2014; CPUC, 2014; ACT, 2014).

The point scores for each mini grid applying for funding will be based on the Point Score System used in the OGEMP to determine priorities for rolling out the Energy Shops (UNDP, 2007). The same system will be used for evaluating the Energy Zones. In addition to the scoring system developed under the OGEMP, points will be given for income generating activities.

The following Point Scoring System will be applied.

Table 27. Point Scoring System for Intervention A

Facility/Point Score Item	Point Score
Constituency capital	80
Health Facilities	
Hospital	80
Health Centre	60
Clinic	40
Outreach point	20
Schools	
Senior secondary school (11-12)	60
Junior secondary school (8-10)	55
Combined school (primary and secondary)	50
Senior primary school (5-7)	40
Junior primary school (1-4)	30
Hostel	60

Facility/Point Score Item	Point Score
Other Infrastructure	
Agricultural development centres	60
Agricultural extension office	20
Per borehole	5
NamPost	15
Per household to be connected	1
Proximity to existing power lines	
Village to power line (0 to <=1km)	not eligible
Village to power line (>1 to <=5km)	not eligible
Village to power line (>5 to <=10km)	not eligible
Village to power line (>10 to <=20km)	0
Income generating activities	
Production activities, such as agro processing units, cooperative milling, bakeries, etc.	20
Service activities, such as ice-making units, internet access, charging of phones	10

Using the Point Scoring System, the Value for Money Index (VMI) will be calculated for each of the mini grids applying according to the following formula:

Mini grids will be ranked according to their VMI in descending order. Proposals with higher VMIs will be given priority over projects with lower VMIs. Projects will receive funding as long as funds from the budget are available.

This method overcomes the problem of setting the "right" percentage when providing grant funding to projects. If the percentage of grant funding is set too high, projects will receive more funding than required and make an extra profit at the expense of the grant provider. If the percentage is set too low, no project will apply for grant funding, as revenue expectations will not be met. A reverse auction can overcome this problem.

6.1.3 Approval Structure for Intervention A

The selection of the mini grids to be financed under the NAMA will be carried out following the steps shown below.

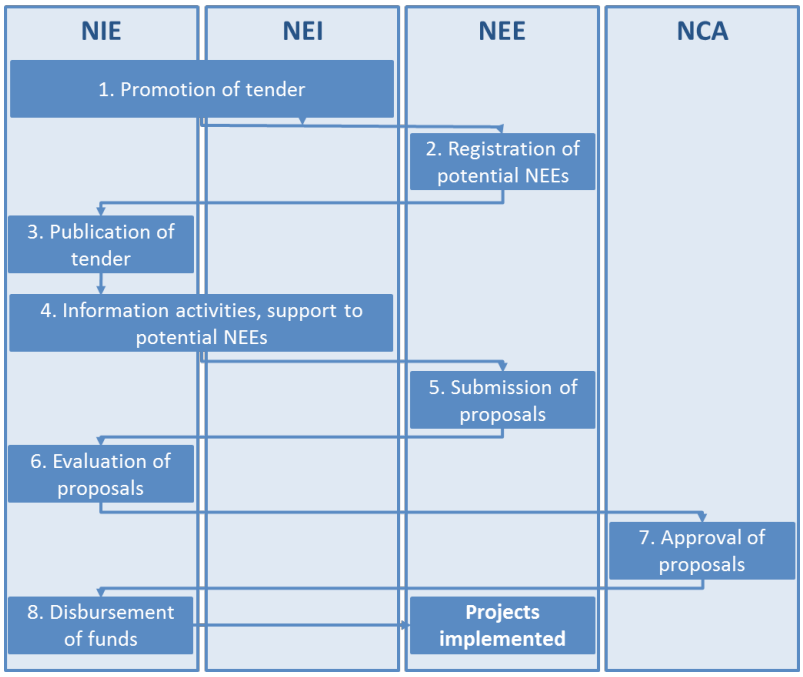
Table 28. Steps in approval process—Intervention A

No.	Step	Description
1	Elaboration and promotion of tender	The NAMA Implementing Entity (NIE) will develop a tender document, which will set out the following: • Background to the tender • The tendering process • Expected outputs (implementation and operation of mini grids) • Tender budget and disbursement • Eligibility criteria • Evaluation criteria • Proposal requirements • Expected financial capacity of applicants • Expected experience and expertise of applicants The upcoming tender will be promoted by the NIE and the Namibia Energy Institute (NEI) to key stakeholders involved in the implementation and operation of mini grids. Promotion will be done through the internet, presentations at conferences/ workshops, newsletters, etc. Focus will be on the following stakeholders: • Regional Councils; • REDs; • Private companies.
2	Registration of potential NEEs	Stakeholders (potential NAMA Executing Entities—NEEs) will be invited to register with the NIE. On registration, potential NEEs will be included in a database, allowing them to receive direct information on further steps of the process either from the NIE or the NEI.
3	Publication of tender	The tender will be published (according to national requirements for tendering). Registered stakeholders will receive direct information on the tender.
4	Information activities and support to potential NEEs during the tendering process	Information meetings will be held in all regions to inform the key stakeholders about the details. Potential NEEs will be able to have open questions clarified. The NIE and the NEI will actively promote the tender to those stakeholders, such as REDs, who have been identified by the NIE as prospective candidates for the implementation of mini grids. All stakeholders registered with the NIE can request technical support for the elaboration of their proposals. This support mechanism will be actively promoted by the NEI. Special focus will be on supporting stakeholders in identifying income generating activities as well as receiving concessions for the mini grids.
5	Submission of proposals	Potential NEEs will submit their proposals to the NIE. Proposals will have to include: • A technical description of the mini grid, confirming its compliance with the eligibility criteria. • A description of its current status of development. • The identification of income generating activities. • The implementation schedule. • The commercial proposal (including the tariff system for consumers). • A description of the project partners and their background.

No.	Step	Description
6	Evaluation of proposals	The NIE, with the support of the NEI, will evaluate the proposals. The first step will be to check whether proposals meet the eligibility criteria. Proposals not fulfilling all criteria will be excluded. For eligible proposals, the VMI will be calculated and all eligible proposals will be ranked by their VMI in descending order. The evaluation will also include a section analyzing the capacity of the tenderers to implement their proposed projects. Evaluation criteria will include (weighting to be decided): • years of experience of the project stakeholders in implementing mini grid, renewable energy or rural electrification projects; • years of experience of the project stakeholders in operating energy or electricity projects; • applicants' financial capacity to cover their own contribution to the project • status of implementation of proposed project; proposals which do not reach 70 per cent of the maximum number of points will be excluded.
7	Approval of proposals	The list of proposed mini grids ranked by their VMI will be sent to the NAMA Coordinating Authority (NCA) for approval. Based on the budget, NCA will approve the list of mini grids eligible for funding.
8	Disbursement of funds	Funds will be disbursed by the NIE. The NIE will monitor implementation to ensure that it has taken place according to the regulations of the NAMA or other country rules.

The following flow diagram shows the approval process and the stakeholders involved:

Figure 22. Approval process—Intervention A



Box 3. Potential Cooperation Models

Community Owned and Operated (COO)

A COO business model would operate a mini grid as a cooperative 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.

Public Private Partnership (PPP)

Under a PPP, the community or state has title/ownership of the assets (the generation and distribution system), and enters into a long-term PPP agreement (of at least 15 years to ensure long-term financial stability) with a private party. The community grants the private partner the concession with an obligation to operate, maintain, and manage generation and transmission assets, to collect consumer based revenues, and make new connections and expansions.

Full Private Sector (FPS)

The private company will invest equity and take on debt to cover the development and implementation costs of a venture.

6.1.4 Actors

The following actors might be involved in the implementation of mini grids.

- Regional Electricity Distributors (REDs)[24] could operate the grids based on their experience with electricity distribution.
- Communities will have a motive for being involved in promoting the mini grids in their areas in order to increase connection rates to the mini grid.
- The private sector could be involved in various roles:
  - As operators (operation, maintenance, billing, etc.)
  - As suppliers, supplying equipment for the mini grids and carrying out installation
  - Financing, providing co-financing for the projects.

There are various models for the modes of cooperation between the different actors. Box 3 gives an overview on three main cooperation models:[25]

- Community Owned and Operated (COO);
- Public Private Partnership (PPP);
- Full Private Sector (FPS).

There is no requirement under Intervention A for any particular type of structure or model of cooperation. Proposals will be evaluated based on their capacity to meet the minimum requirements and to achieve the required results.

24 REDs have the task to supply electricity to final consumers in their regions. Also, they have experience in all matters related to electricity supply, such as invoicing, consumer relationship management, maintenance, etc. Therefore, REDs would be an excellent partner for the operation of mini grids. Their lack of experience in operation of electricity generation units should not really matter, as solar and solar hybrid power projects are fairly easy to operate.

25 For more details on the pros and cons of the different models, see UNDP, 2014c.

6.1.5 Proxies and targeted impact of the intervention

The values below are used for the ex-ante estimation of the NAMA's impact on GHG emissions reduction and achieving the SD indicators set out in the sections below. The values are for one implemented mini grid. The total impact of the NAMA Intervention A is the sum of all implemented mini grids.

Table 29. Assumed and targeted impact of Intervention A

Installed capacity	100 kWp
Proxy RE technology	Photovoltaic
Annual electricity production[a]	110,000 kWh
Annual GHG saving/avoidance	110 tons CO_2
Number of health care institutions (clinics) electrified	1
Number of households electrified	100
Number of people with access to RE electricity	600
Number of educational institutions (schools) electrified	1
Number of new income-generating activities (enterprises)	5
Number of new jobs (total)	2
Number of new jobs for women	1

[a] *Estimated using IET, 2012.*

6.2 NAMA Intervention B - Energy Zones

6.2.1 Activities under Intervention B

The OGEMP defined the concept of Energy Shops. Energy Shops are established within a reasonable distance of targeted communities and sell suitable, approved energy products and compatible appliances to consumers. Under Intervention B, this concept is developed further into the concept of Energy Zones (EZs), by adding a Rural Productivity Zone (RPZ)) component.[26]

Energy Zones will be:

- in centres in off-grid areas as defined in the OGEMP (UNDP, 2007);
- new stand-alone RE installations (solar PV, wind, hydro) providing electricity in one building/compound;
- promoting new entrepreneurial activities by providing space and electricity for Internet cafes, sewing workshops, ice-making, agro-processing, etc.;
- places where village households will be able to charge their batteries, on a daily basis or after two days, for use for lighting and other basic needs;
- an outlet for the sale of energy appliances (solar lanterns, light bulbs, etc.), with a focus on rural electrification with renewable energies.

26 See Box 1 and UNDP, 2014c.

6.2.2 Eligibility criteria

In order to be able to receive funding under the NAMA, an Energy Zone will have to meet the eligibility criteria outlined in Table 26.

Table 30. Eligibility criteria, Intervention B

Eligibility criterion	Description
Location	The Energy Zone must be off-grid as defined in the OGEMP.
Energy Zone Operator	Must have been in business for at least three years. Must provide information to prove the business's stability.
Space	There must be minimum space of 50 m^2 for income generating activities in the company's building or in adjacent buildings (whose distance from the building of the operator must be no more than 50m). Alternatively, there should be space to erect additional buildings to host income generating activities.
Technical feasibility	It must be technically feasible to install solar PV and the related battery storage. Roof-mounted solar PV is preferred.
Income generating activities	The operator must provide a list of potential income generating activities with an estimate of approximate demand.

6.2.3 Approval Structure for Intervention B – Energy Zones

The selection of the Energy Zones to be financed under the NAMA will be carried out in the following steps.

Table 31. Steps in approval process—Intervention B

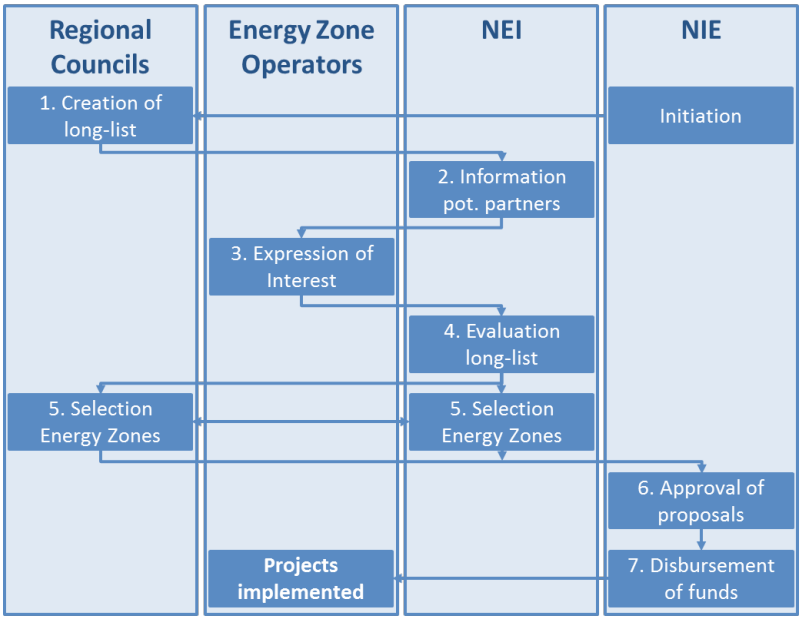
No.	Step	Description
1	Creation of long-list	Regional Councils have already played an important part in selecting the Energy Shops implemented under the OGEMP. They have good information about potential locations for additional Energy Shops[27] and potential partners. The NIE will invite Regional Councils to investigate and come up with a long-list of potential partners for Energy Zones and collect information on these partners. This information should include: • Name • Location • Contact details • Core business • Year of establishment • Number of employees • Approximate turnover per year • Space available (in m^2) for income generating activities The list should contain between three and six potential locations in each region.

27 When finding new locations for Energy Shops, it is recommended that the portfolio of products the shops are offering has a stronger focus on renewable energies, such as solar and efficient cook stoves. The share of technologies with conventional energies should be reduced.

No.	Step	Description
2	Information for potential Energy Zone partners	The NEI will prepare a toolkit on Energy Zones and send this to each of the potential partners. The folder will contain a general description of the concept of Energy Zones, the requirements that potential Energy Zone partners must meet, and the financial implications of running an Energy Zone. The NEI will follow up with each potential partner by phone to answer any questions.
3	Expression of Interest	Potential partners for Energy Zones long-listed by the Regional Councils will be invited to prepare an Expression of Interest, which will commit them to operate an Energy Zone if selected. As the operators of Energy Zones will be Executing Entities under the NAMA, the Expression of Interest will also include acceptance of general terms and conditions for the operation of Energy Zones under the NAMA (general terms and conditions will be developed by the NIE). These general conditions will mainly regulate requirements for the operation of Energy Zones, financial implications and reporting requirements under the MRV.
4	Evaluation of long-list	As in the case of the Energy Shops, the long-list provided by the Regional Councils will be evaluated by the NEI. The evaluation of the NEI will be based on the eligibility criteria as well as interviews with potential operators of Energy Zones. All potential partners not fulfilling eligibility criteria for "location" and "space" will be excluded. The NEI will prepare an evaluation based on the following criteria (weighting to be decided): • Stability of business • Technical feasibility • Number of income generating activities • Number of women employed The NEI will propose a ranked shortlist of three potential Energy Zones.
5	Selection of Energy Zones	The ranked shortlist will be discussed between the Regional Councils and the NEI and a final ranking will be jointly decided. The ranking will be forwarded to the NIE for approval.
6	Approval of proposals	Based on the budget, the NIE will approve the list of Energy Zones eligible for funding.
7	Disbursement of funds	Funds will be disbursed by the NIE. The NIE will monitor implementation to ensure that it has taken place according to the regulations of the NAMA and other country rules.

The following flow diagram shows the approval process and the stakeholders involved.

Figure 23. Approval process—Intervention B



6.2.4 Actors

The following actors may be involved in the implementation of Energy Zones.

- Private sector companies are to be the anchor of Intervention B. They will integrate the concept of Energy Zones into their existing businesses, which will create a stable basis for further income generating activities.
- Regional Councils and communities will be involved in selecting potential service providers, companies and locations.

6.2.5 Proxies and targeted impacts of Intervention B

The values below are used for the ex ante estimation of the NAMA impacts in GHG emission reductions and reaching the SD indicators in the sections below. The values are for 1 (one) implemented Energy Zone. The total impact of the NAMA Intervention B is the sum of all implemented Energy Zones.

Table 32. Assumed and targeted impact of Intervention B

Installed capacity	10 kWp
Proxy RE technology	Photovoltaic
Annual electricity production[a]	18,000 kWh
Annual GHG saving/avoidance	18 tons CO_2
Number of health care institutions (clinics) electrified	0
Number of educational institutions (schools) electrified	0
Number of households having access to RE electricity services	30
Number of people with access to RE electricity services	180
Number of new income-generating activities (enterprises)	2
Number of new women enterprises	1
New sales points for RE&EE technologies	1

[a] *Estimated using IET, 2012.*

7 NAMA Implementation Structure

7.1 Actions to Institutionalize the NAMA

The coordination and management of the NAMA requires an institutional structure, which shall meet the following requirements.

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

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

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

7.2 Institutional Framework for NAMA Implementation and Management

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

- a NAMA National Focal Point or National NAMA Approver (NA);
- a NAMA Coordinating Authority (NCA);
- a NAMA Implementing Entity (NIE);
- NAMA Executing Entities (NEEs).

National NAMA Approver/Focal Point

The national NAMA Approver or Focal Point shall inter alia:

- approve NAMAs which shall be registered at the UNFCCC;
- report to the Climate Change Steering Committee (CCSC) about international developments and the status of the national NAMA portfolio, and follow the guidance of the CCSC in international negotiations;
- provide guidance to sectoral NAMA coordinating entities (access to climate finance, financial flows, MRV etc.);
- issue procedures for accounting of emission reductions to avoid double counting of emission reductions from various implemented NAMAs;
- support the preparation of the National Communication, Biennial Update Reports, Summary of GHG Reductions etc.

The **Ministry of Environment and Tourism** has already been appointed as NAMA Approver/Focal Point to the UNFCCC and as the National Designated Authority (NDA) to the GCF.

The NAMA Coordinating Authority (NCA)

The NAMA Coordinating Authority (NCA) is the entity which coordinates the proposed NAMA on rural electrification. Its main tasks are:

- acting as primary contact for international donor(s);
- managing and directing the NAMA;
- approving
  - NAMA targets,
  - the implementation process with regard to the submission of project applications and the disbursement of funds (in close collaboration with the NCCC, the NAMA Focal Point, the NIE);
- approving and updating eligible interventions;
- approving annual monitoring reports prepared by the NIE (covering inter alia the number of projects implemented, the calculation of emission reductions etc.); and
- supervising the financial flows between donors and beneficiaries.

In addition to the role as NAMA Approver and Focal Point, the **Ministry of Environment and Tourism** will also acts as NAMA Coordinating Authority (NCA).

NAMA Implementing Entity (NIE)

The NIE will be responsible for handling financial flows from funding entities to the beneficiaries as well as for project approval. The NAMA Implementing Entity (NIE) is the main operative body of the Rural Electrification NAMA in Namibia.

The main tasks of the NIE are to:

- ensure the proper transfer and disbursement of funds from the donors to the recipients based on an agreed set of criteria (e.g. money will be held in a trust account with limited access, money will be disbursed only after the project has been implemented, etc.);
- prepare reports to the NCA/donor(s) about e.g.,

  - the use of funds,
  - the number of projects implemented,
  - targets achieved etc.;
- capacity-building for institutions and companies involved in the implementation of the NAMA (e.g. micro-grid operators and equipment suppliers);
- development of technical standards for equipment/installations used under the NAMA;
- coordination of promotion and awareness raising campaigns and of support for the implementation of the NAMA;
- integration of the private sector into NAMA implementation;
- coordination of monitoring activities and preparation of monitoring reports for all interventions;
- facilitation and coordination of verification through the external entity designated for this task;
- reporting to the NCA in fulfilment of reporting requirements to the donor; and
- cooperation with internal and external financial auditors.

The NIE needs to have a strong background and good track record in financing. Therefore, it makes sense to recruit external experts to provide support to the NIE on technical financial issues. The distribution of work between the NIE and the technical experts will be agreed before the start of NAMA implementation.

The **Environmental Investment Fund (EIF)**[28] will take the role of NAMA Implementing Entity (NIE). The EIF was established by an act of parliament as a statutory entity outside the public service. The EIF is run by a board of directors, which receives advice from a technical advisory panel and has a staff of around 10 people The EIF offers grants, green soft loans and green concessional loans. Its work experience demonstrates that the fund has the capacity also to meet the requirements of the GCF.

The EIF will be supported by technical experts of the Namibian Energy Institute (NEI). The NEI was launched in 2006 following the signing of a cooperation agreement between the Polytechnic of Namibia (technical university) and the Ministry of Mines and Energy (MME). The main sponsor of the NEI is the Government of Namibia, by way of a grant through the MME. The institute serves as an information dissemination platform and plays a leadership role in the transition of knowledge from traditional energy sources and usage to a more sustainable energy economy.[29]

NAMA Executing Entities (NEEs)

The NAMA Executing Entities (NEEs) are the companies and/or institutions which will implement projects under the two interventions. Each NEE will:

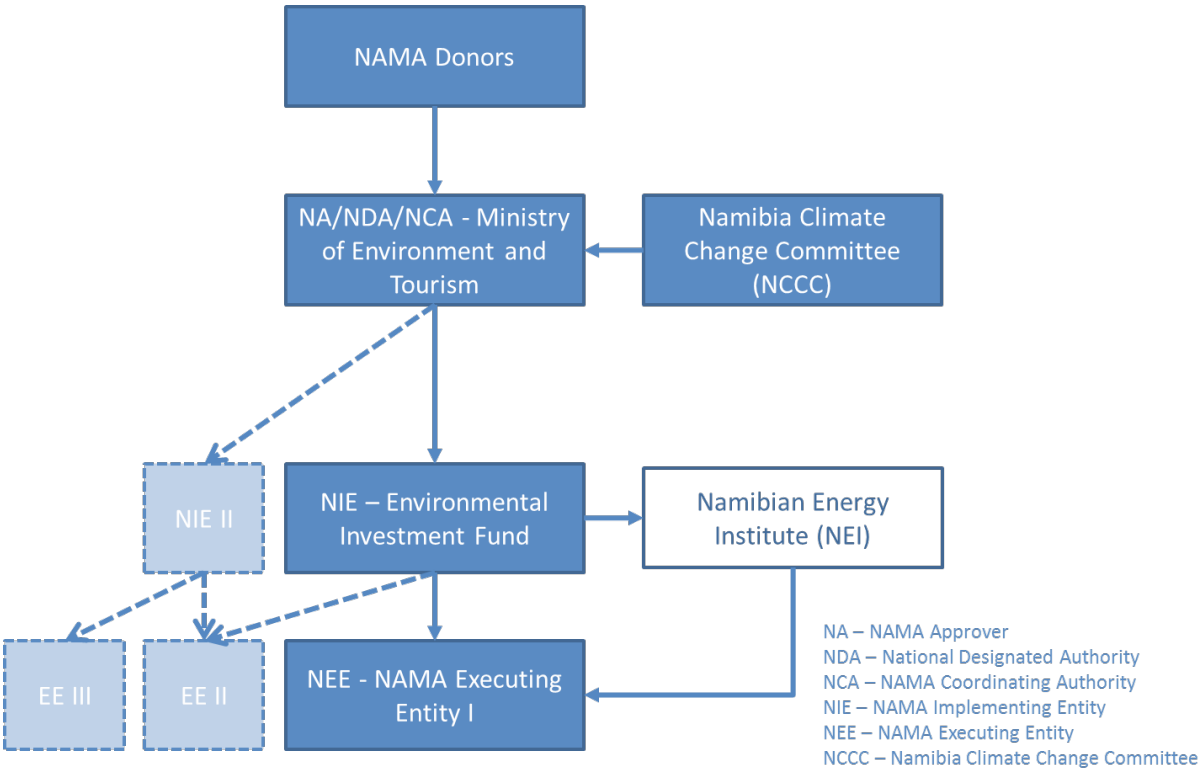
- implement projects in compliance with the rules of each intervention;
- inform the NIE about the performance of their projects; and
- collect data for monitoring purposes (requirements will be communicated by the NIE based on the MRV).

The existing **Namibia Climate Change Committee (NCCC)** will act as the supervisory board for the NAMA. The NCCC consists of relevant ministries and stakeholders (including the Ministry of Environment and Tourism, the Ministry of Mines and Energy, and Nampower). The NCCC has the powers to establish working groups and subcommittees as needed. It is recommended that a working group on the NAMA is created, which also includes additional key stakeholders (industry representatives, NGOs).

28 www.eifnamibia.com.
29 www.reeei.org.na.

The following organizational diagram illustrates the recommended institutional structure of the NAMA described above. The Ministry of Environment and Tourism will be the core stakeholder in the NAMA due to its various functions. Bilateral funding entities or donors will be in direct contact with the Ministry of Environment and Tourism. The CCSC will act as the national high level political supervisory body of the NAMA. The direction of financial flows is described in chapter 10.

Figure 24: NAMA organizational diagram



8 Institutional and Sectoral Capacity Development Needs

The NAMA capacity development (CapDev) programme will enable the smooth launch of the NAMA and contribute to the successful implementation of its activities.

The proposed NAMA capacity development programme will consist of two components:

- Component 1 will target **support for the launch and implementation** (e.g. definition of laws and processes, preparation of documentation) of the NAMA and will provide capacity-building for the involved (semi-) governmental entities (such as the NIE or the NA).
- Component 2 will focus on the **awareness raising, marketing side of the NAMA after implementation** and will provide
  - general capacity development to create a common awareness for the NAMA; and
  - specific stakeholder-oriented capacity-building.

The capacity development programme will be led by international consultant(s) with the support of national experts. The first component will be carried out by international/national consultants only. In the second component NCA and NIE staff who have been trained in the first component will start to provide seminars/ trainings and workshops.

8.1 Component 1: Capacity Development for the NAMA Launch and Implementation

The CapDev programme for implementation will support:

- implementing a NAMA working network and processes (technical and financial project cycle), including staff training;
- implementing NAMA related regulations and designing the contractual conditions;
- preparing NAMA project documentation (application forms, call and tender documents, procurement rules, monitoring, evaluation and reporting forms, etc.)

This component will focus solely on activities which have to be performed by the NAMA Coordinating Authority and the NAMA Implementing Entity as further explained in section 8.2. Capacity development for implementation will be carried out by international/national consultants only.

Implementing a NAMA network, processes and the financial cycle

This part of the CapDev programme will

- facilitate the establishment of the NAMA entities and specific positions for NAMAs within the structures of the other stakeholders involved by holding multilateral and bilateral meetings and workshops;

The **appointed technical NIE** will be supported during process implementation by providing:

- train the trainer programmes about objectives, benefits and procedures of the NAMA (the NIE will then be able to offer training to the general public, EEs, banks and equipment suppliers);

- case study training for project approval and verification;
- training in the identification of income generating activities, and support to new entrepreneurs in developing their business and achieving market access;
- training in MRV for GHG emission reductions and SD co-benefits;
- training in developing an infrastructure protection plan for the renewable energy facility to increase the climate resilience of the community;
- a design for the designation of authority and for time frames for process steps within the NIE;
- training on reporting to the NCA;
- identify staff for NAMA positions in the organizations involved, provide individual turnkey know-how and training to entities and individual personnel;
- prepare a communications structure and informing procedures, and contact lists for the network; and
- prepare the financial processes cycle.

The **appointed financial NIE** will be supported during process implementation by:

- providing training on energy efficiency in general and the garment industry specifically;
- providing training on eligible energy efficient equipment under this NAMA;
- preparing lists of suppliers;
- designing designation of authority and time frames for process steps within the NIE;and
- providing training on reporting to NCA.

Regulations and Contractual Conditions

This part of the CapDev programme will:

- draft, in close cooperation with government, required amendments to the existing regulations and new regulations, as required (following the recommendations relating to specific documents set out in the Gap Analysis in section 5.4);
- assist in the approval of the new regulations by holding consultative meetings with responsible authorities;
- draft contractual conditions and documents setting out the relationships between the NAMA stakeholders, as required (e.g. to distribute competencies between the ministries);
- The support contract to be signed by the technical NIE and the Executing Entities will be designed by the NIE (with the support of the capacity-building programme) and will contain at least:
  - name and address of the legal entity asking for support;
  - a description of the equipment to be purchased by the Executing Entity;
  - amount of subsidy given;
  - reference to the legal framework for this NAMA and approval procedures;
  - the period for finalizing the purchase of equipment and issuing invoices to the NIE;
  - reporting requirements by the EE; and
  - payment conditions.

Preparing NAMA project documentation

This part of the CapDev programme will help to;

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

8.2 Component 2: Awareness raising and marketing

This CapDev component will consist of general and specific activities.

General activities

A countrywide generic marketing/awareness raising strategy for the NAMA will create a common understanding of the benefits of rural electrification, renewable energies and energy efficiency, and explain the NAMA's objectives and procedures.

Organizing a NAMA Launch Event

The launch event will be the countrywide kick-off for the NAMA and will provide information about the objectives, stakeholders and timelines. The launch event will include a press briefing and will provide some informal networking opportunities.

Designing/Maintaining the NAMA Website

The web page is one of the main communication tools of the NAMA providing the information about:

- the qualification criteria for projects;
- case studies;
- best practice;
- success stories;
- templates;
- news and achievements of the NAMA; and
- donors.

Coordinating General NAMA Awareness Raising Events

In addition to the launch event, four general awareness raising events will be organized per year (during the first three years of the NAMA), which will market the idea of REs and energy efficiency, the specifics of Namibia's NAMA, its objectives and opportunities, and explain the NAMA procedures.

Support in Business Development

Focus will be given to supporting new entrepreneurs in developing their income generating activities. This will include support on technical issues, such as production techniques, as well as general business development issues such financing of production, product selection, client selection and market access.

Preparing/Disseminating NAMA Marketing Materials

Typical materials will include leaflets, pens, notepads, a best practice guide, folders, banners, etc.

Cooperation with Public and Private Media

There will be continuous information to the media about the implementation and outcomes of the NAMA.

Stakeholder-Targeted Activities

These marketing/awareness raising strategies will aim to ensure widespread participation in the NAMA.

This chapter refers only to capacity-building activities, tailored to the needs of the specific stakeholders (with the exception of the NCA and NIE, whose capacity-building programme is already covered under Component 1 and under the generic activities of Component 2) and provided by international experts. The main stakeholders of the NAMA have been described in section 8.2 on the NAMA's institutional set-up.

The National Climate Change Committee

The NCCC acts as the high level authority coordinating and monitoring the implementation of the Government's policies, strategies, regulations, plans and programmes on climate change issues. Aside from the generic marketing/awareness activities there will not be any specific NAMA related capacity-building.

National NAMA Approver

The NA (the Ministry of Environment and Tourism) acts as the interface with the international authorities with a stake in climate change policies. Its most important NAMA task is to avoid double counting of emission reductions. Therefore NA specific capacity-building will focus on:

- supporting the exchange of know-how with other countries which are implementing or have implemented industrial energy efficiency NAMAs; and
- the NAMA's MRV system.

Executing Entities

Executing Entities are the companies which will invest in the NAMA interventions (micro grids or Energy Zones) by buying the technology, equipment and related services.

Workshops and presentations on NAMA objectives, eligibility, procedures, etc. will be provided in each region.

In addition, for the potential Energy Zone operators, special, detailed workshops and training will be provided because they are expected to lack information, awareness and competence in basic equipment maintenance (based on the lessons learnt from the Energy Shops programme).

Banks/ credit providers

National banks provide financing to Executing Entities for the purchase of the equipment that is needed. Therefore it is important that banks understand the concepts and benefits the NAMA interventions as a new business opportunity.

Specific capacity-building activities for banks will include:

- presentations at round table meetings with the most relevant banks, initially at headquarters level and then jointly with the banks´ management of selected branches (if applicable);

- screening of banks´ client portfolios for potential lending opportunities;
- joint development of new loan products;
- distribution of guidance to banks loan officers notifying them of business opportunities under this NAMA;
- introductions and exploratory visits in cooperation with bank branches to potential clients;
- conducting customer meetings together with loan officers.

Suppliers and installers of RES technologies

General information on the NAMA's business potential will be provided to the companies registered at the MET.

9 Costs and Finance

9.1 Costs of Intervention A – Mini grids

So as to receive competitive proposals under Intervention A, the reverse auction approach was chosen. The benefit of this approach is that it encourages applicants to come up with the lowest possible financial proposals. The preferred business model will most likely be the IPP method under which the bidder builds and operates the mini-grid for a period of time and provides power to the community. The reverse auctioning method is described in Chapter 7.

However, with this approach it is difficult to estimate the (exact) investment costs involved in setting up a mini grid and the corresponding grant support an applicant should receive.

Investment costs for solar hybrid mini grids (solar PV plus diesel back-up) are in a range of US$5,000-10,000 per kWp installed capacity (IED, 2013). This is in line with experience from the few mini grids in Namibia—investment costs for the Tsumkwe solar PV mini grid, for example, were US$8,900 per kWp (excluding costs for capacity-building).

Cost examples in the recent UNDP guidance paper were slightly higher (around US$12,000), as the sample project was smaller in size and assuming standard EPC contracting (UNDP, 2014c).

For the purpose of this NAMA, we assume the same costs as for the Tsumkwe mini grid, which was built in 2011. This is conservative as the costs for some of the solar power equipment, such as solar panels, have decreased over the last 4 years. The assumed cost of US$8,900 per KWp includes equipment, connections, engineering costs and supervision. The supplier's margin involved in setting up a mini grid is not included as this is expected to be recovered from electricity sales. Assuming that up to 10 mini grids can be implemented in a first phase of the NAMA, and assuming average costs of US$8,900 per kWp installed capacity of 100 kW, total investment costs will be around US$8.9 million.

9.2 Costs of Intervention B – Energy Zones

The cost of setting up an Energy Zone consist of two components.

- The Energy Shop component. Setting up an Energy Shop usually includes putting up a lightbox (N$12,000), installing a display board with all components (N$25,000), and running an awareness raising campaign with music/marketing materials/food (N$40,000). Thus, the total cost of setting up one Energy Shop is around N$80,000 (about US$7,000).[30]
- The solar PV and Rural Productivity Zone component. This includes the Solar PV panel, batteries for electricity storage and equipment to connect income-generating activities (basically electricity installation for the building/complex in which the Energy Zone is located). The Energy Zone will be offered in a standard size with a capacity of 10 kWp. An installation of this size will carry loads able to meet the needs for the following:
  - lighting for Energy Zone;
  - sewing machines;
  - mechanical tools;
  - computers and printers;
  - a mobile phone charging station;
  - a refrigerator/freezer.

30 These are concrete figures from the installation of the first Energy Shops in Namibia.

Installation costs of the solar PV system of one Energy Zone are estimated at around US$190,000. The total investment cost of installing one Energy Zone in each of the 13 provinces is then US$2.47 million for the PV component and US$91,000 for the Energy Shop component.

It is recommended that a tendering process is used for this component in order to reduce overall costs.

The availability of funding under the NAMA will determine the specific number of Energy Zones that will be implemented. The Energy Shop component will be covered by the Government of Namibia, the Solar PV and Rural Productivity Zone component will be financed by the NAMA donor.

It is expected that the potential operators of the Energy Zones will not have the financial means to contribute to the financing of the zones. Therefore it is proposed that the funding is provided as grant funding. This will give operators an interest in attracting as many income-generating opportunities as possible in order to create additional income. This will help them develop the financing capacity to build up stock in their Energy Zones, thereby curbing the sale of energy equipment.

Operators of Energy Zones will be required to pay 10 per cent of their monthly electricity sales into a Maintenance Fund. The Maintenance Fund will be managed by the Environmental Investment Fund (EIF). The money paid into the fund will allow maintenance of the equipment and replacement of broken parts.

9.3 Capacity Development and NAMA Operating Costs

Based on the tasks and responsibilities described in chapters 9.1 and 9.2, costs for capacity- building were estimated. Capacity-building will take place during the first five years of the NAMA. In the first three years, focus will be on preparing the two interventions for implementation. In years 4 and 5, focus will be on capacity-building and guidance during implementation. The costs for capacity- building by year and component are shown in the following table.

Table 33. NAMA capacity-building costs
(US$)

				Year 1		Year 2		Year 3		Year 4 - 5		Total
No	Cost component	Units	Unit rate	No units	Costs	No units	Costs	No units	Costs	No units	Costs	Year 1-5
1	Human Ressources											
1.1	Local Salaries/Consultants											
	NAMA Team Leader	Month	2,400	12	28,800	12	28,800	12	28,800	24	57,600	144,000
	Mini grid expert	Month	1,500	12	18,000	12	18,000	12	18,000	24	36,000	90,000
	Mini grid expert	Month	1,500	12	18,000	13	19,500	13	19,500			57,000
	Business development expert	Month	1,500	12	18,000	14	21,000	14	21,000			60,000
	Energy Shop expert	Month	1,500	6	9,000	15	22,500	15	22,500			54,000
	Awareness raising expert	Month	1,500	6	9,000	12	18,000	12	18,000	24	36,000	81,000
	Technical expert	Month	1,500	6	9,000	12	18,000	12	18,000	24	36,000	81,000
1.2	International Salaries/Consultants											
	NAMA and policy expert	Month	12,000	12	144,000	12	144,000	12	144,000	24	288,000	720,000
	Rural electrification expert	Month	12,000	12	144,000	13	156,000	12	144,000			444,000
	Awareness raising expert	Month	10,000	12	120,000	12	120,000	12	120,000			360,000
	Subtotal Human Ressources				517,800		565,800		553,800		453,600	2,091,000
2	Travel											
2.1	International travel	Flight	2,000	9	18,000	9	18,000	9	18,000	28	56,000	110,000
2.2	National travel	Travel	200	30	6,000	30	6,000	30	6,000	60	12,000	30,000
2.3	Per diems				-		-		-		-	
2.3.1	Abroad	Per diem	150	30	4,500	30	4,500	30	4,500	60	9,000	22,500
2.3.2	Local	Per diem	150	80	12,000	80	12,000	80	12,000	160	24,000	60,000
	Subtotal travel				40,500		40,500		40,500		101,000	222,500
3	Equipment											
3.1	Furniture, computer equipment	Place	2,500	7	17,500							17,500
	Subtotal equipment				17,500		-		-		-	17,500
4	Local office											
4.1	Office rent	Month	1,000	12	12,000	12	12,000	12	12,000	24	24,000	60,000

				Year 1		Year 2		Year 3		Year 4 - 5		Total
4.2	Consumables	Month	250	12	3,000	12	3,000	12	3,000	24	6,000	15,000
4.3	Other services (tel/fax, electricity,..	Month	250	12	3,000	12	3,000	12	3,000	24	6,000	15,000
	Subtotal local office				18,000		18,000		18,000		36,000	90,000
5	Other costs services											
5.1	Publications				5,000		5,000		5,000		10,000	25,000
5.2	Expenditure verification				20,000				20,000		20,000	60,000
5.3	Costs of conferences/seminars											
	NAMA Launch Event				5,000						-	5,000
	NAMA Awareness Raising Events	Event	1,000	4	4,000	4	4,000	4	4,000	4	4,000	16,000
5.5	Website/marketing material											
	Website/website management				2,000		1,000		1,000		2,000	6,000
	Marketing materials				8,000		4,000		4,000		5,000	21,000
	Subtotal other costs services				44,000		14,000		34,000		41,000	133,000
	Contingency (5%)				31,890		31,915		32,315		64,230	160,350
	Project administration (7%)				44,646		44,681		45,241		89,922	224,490
	Total Costs				714,336		714,896		723,856		785,752	2,938,840

9.4 National and International Finance

Financial flows and management are a cornerstone of any NAMA, as they tie together many of the main NAMA components. In the context of this NAMA, the main focus will be on how to build and integrate a reliable and transparent structure of financial governance into the NAMA and how to manage the financial flows and the controls required to ensure a sustainable use of funds. The basis of this NAMA is a co-financed effort between the Government of Namibia and international partners/NAMA donors. Therefore, this NAMA considers two primary tracks of finance, national finance and international finance.

National Finance: For the purpose of this NAMA, national finance is defined as financial flows or capital directly influencing the ventures and incentives designed under the NAMA, and which are within the operational control of the national Government. In this NAMA, it is proposed that national finance will include the following financial flows:

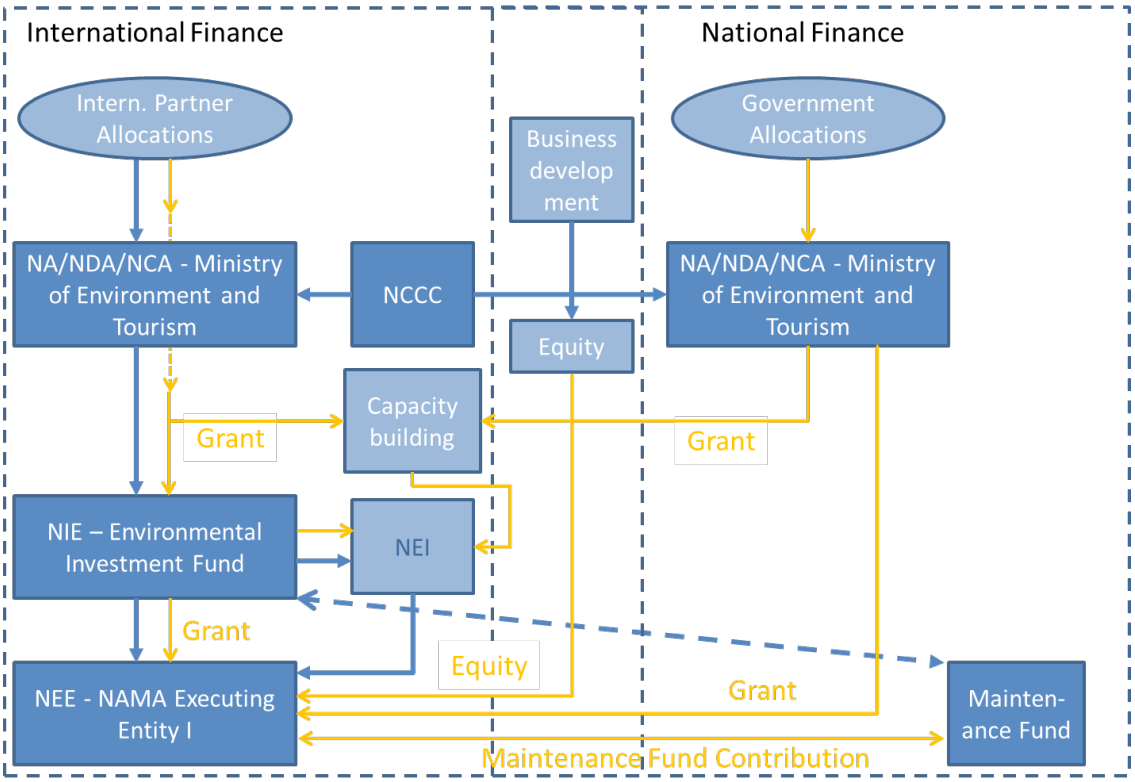
- capacity-building (further described in section 9);
- grant contributions to Intervention A, covering part of the investment costs of the mini grids;
- grant contributions to Intervention B, covering the costs of Energy Shops and part of costs of Energy Zones (section 7.2);
- payments by consumers (both households and companies);
- contributions from the operators of the Energy Zones to the Maintenance Fund (section 7.2).

International Finance: For the purpose of this NAMA, international finance is defined as financial flows or capital directly influencing the interventions designed under the NAMA and which originate from and are controlled by international partners (consisting of multilateral financing institutions and/or multilateral/bilateral programmes). The capital provided by international partners will be used only for direct investment grants in Interventions A and B (Section 7). The contributions will be channelled directly from the partners to the NIE (the Environmental Investment Fund), which will then disseminate the funds to Executing Entities (EE) in both Intervention A and Intervention B.

For each of the tracks, there are two components: 1) the management and governance of capital and 2) the disbursement of funds. This means that there must be established bodies to provide for strategy, oversight and governance, implementation and operation. Figure 27 is a flow chart showing the flow of funds from both sources.

Since the NAMA is based on the principle of Output Based Aid (OBA), it is very important that the expectations of the NAMA stakeholders and their outputs are clearly and realistically defined at the start of NAMA implementation. There should be some flexibility in budgeting and in the completion of outputs, taking into account overall performance as well as minimum performance.

Figure 25. Flow chart of national and international finance



International contributions will be directly channeled to the NIE. Part of the money will be given as grants to NEEs, part will be used for capacity-building. National financing will contribute through grants to financing the investments of NEEs and supporting capacity- building efforts. Private sector players (national or international) will contribute with equity to the financing of NEE activities. From the income generated by the NEEs, contributions will be made to the Maintenance Fund.

Based on the cost estimates for Intervention A (see section 10.1), Intervention B (see section 10.2) and capacity-building (see section 10.3), the following table gives an overview on total NAMA implementation costs as well as the contributions of national and international sources.

For Intervention A, it is assumed that the average grant requested from applicants is 75 per cent of the cost, with the remaining 25 per cent being financed by the private sector. Out of the 75 per cent grant contribution, one third will be covered by the Namibian Government, two thirds by the NAMA donor.

For Intervention B, the costs of the Energy Shops (US$91,000) will be covered by the Namibian Government. Additionally, the Government will cover one third of the costs of the Energy Zones. Two thirds of the Energy Zones costs will be covered by the NAMA donor(s).

Costs for capacity-building will be shared between the Namibian Government and the NAMA donor(s) in the ratio one third to two thirds.

The following table summarizes the assumed cost contributions from the Namibian Government, the private sector and the NAMA donor(s).

Table 34. Contributions to NAMA financing
(US$)

	Namibian Government	Private sector	NAMA donor
Intervention A	2,202,750	2,225,000	4,473,410
Intervention B	893,000	—	1,647,000
Capacity- building	978,840	—	1,960,000
Total	4,074,590	2,225,000	8,080,410

The following table shows the cost contributions by year, activity and source (Namibian Government, private sector, NAMA donor(s)). In total, the Namibian Government will contribute around 30 per cent of the financing for the NAMA. This funding will have a certain lead time, and the contributions of the Namibian Government will therefore be lower in the earlier than in the later years.

Table 35. Contributions to NAMA financing by year and activity
(US$)

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Intervention A	—	1,000,000	4,500,000	2,000,000	—	7,500,000
Intervention B	—	540,000	1,500,000	500,000	—	2,540,000
Capacity- building	715,000	715,000	724,000	393,000	393,000	2,940,000
Total	715,000	2,255,000	6,724,000	2,893,000	393,000	12,980,000
Namibian Government	162,984	235,967	2,444,754	896,410	334,475	4,074,590
Private Sector	—	267,000	1,335,000	623,000	—	2,225,000
NAMA donor(s)	404,021	2,020,103	3,716,988	1,616,082	323,216	8,080,410
Total	567,005	2,523,070	7,496,742	3,135,492	657,691	14,380,000

10 NAMA Measurement, Reporting and Verification

As a NAMA is an instrument of output based aid, the results of implemented NAMAs need to be measurable, reportable and verifiable (MRV) to attract donors and to guarantee the sustainable success of the interventions introduced.

The methodology for monitoring the effects of NAMAs needs to follow the general principles of transparency, consistency, comparability, completeness and accuracy. This applies to all the components to be monitored. The objective of the MRV framework is to provide a credible and transparent approach for quantifying and reporting GHG emission reductions.

An MRV framework includes the following elements.

1. System boundary definition
The system boundary encompasses significant anthropogenic GHG emissions by sources under the control of the project participant that are reasonably attributable to the NAMA intervention as a project activity.

2. Baseline scenario
The baseline scenario is the scenario for a project activity that reasonably represents the anthropogenic emissions by sources of GHG that would occur in the absence of the proposed project activity, i.e. the NAMA intervention.

3. Project activity scenario
The project activity scenario is a NAMA intervention—in this instance a mini grid or Energy Zone—and the related anthropogenic emissions by sources of GHG that occur due to the project activity.

4. Emissions reduction calculation
The GHG emissions reduction achieved by the project activity will be determined as the difference between the baseline emissions and the project emissions.

5. Monitoring
Defines the parameters to be monitored.

6. Reporting and verification
Defines the reporting requirements and verification procedures.

10.1 Measurement and Monitoring of GHG Emission Reductions

The total GHG emissions reductions of the NAMA in a given year y (ERy) are the sum of the emissions reductions achieved by implementation of Intervention A – Mini Grid and the emissions reductions achieved by implementation of the intervention B – Energy Zones:

Equation 1: $ER_y = ER_{A,y} + ER_{B,y}$

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

Equation 2: $ER_y = BE_y - PE_y$

Where:

Parameter	Description	Unit
ER_y	Emission reductions over the time period y	tCO_2
BE_y	Baseline emissions over the time period y	tCO_2
$PE_{,y}$	Project emissions over the time period y	tCO_2

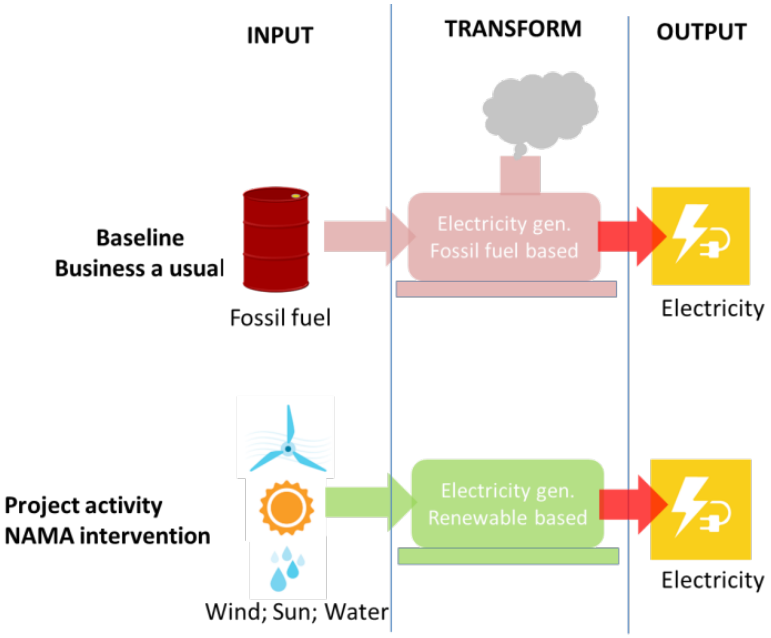
10.1.1 Baseline

As described in section 6.3, the baseline scenario is defined ex ante and derived from the fossil fuel-based electricity generation system (e.g. diesel generators), which burns fossil fuel as the energy input to produce electricity as an output, thereby producing the CO_2 emissions.

Under the NAMA interventions as a project activity renewable based electricity generation systems will be applied, which use wind, sun or water as the source of the energy input to produce zero emission electricity as output.

The baseline and project activity scenarios are as depicted in the figure below.

Figure 26. General concept—baseline vs. NAMA intervention



10.1.2 GHG Emission Reductions under Intervention A – Mini grids

The GHG emission reductions under Intervention A in a given year y ($ER_{A,y}$) are calculated by comparing actual (project) emissions ($PE_{A,y}$) with the emissions under the baseline scenario ($BE_{A,y}$).

Equation 2a: $ER_{A,y} = BE_{A,y} - PE_{A,y}$

Assumptions:

- A mini grid is characterized by short distances between the source of electricity generation and electricity consumers, thus the grid losses are minor and can be neglected.
- All the generated electricity under the NAMA intervention will be consumed, thus the generated electricity is equal to the consumed electricity.

System boundary:

The project activity is defined by the introduction of a mini grid as NAMA intervention, and thus the project boundary encompasses the mini grid, the source of electricity generation, and the consumer(s) of the electricity.

The baseline is electricity generation by combustion of a fossil fuel (e.g. diesel generator).

Figure 27. Baseline scenario for Intervention A—Mini Grid

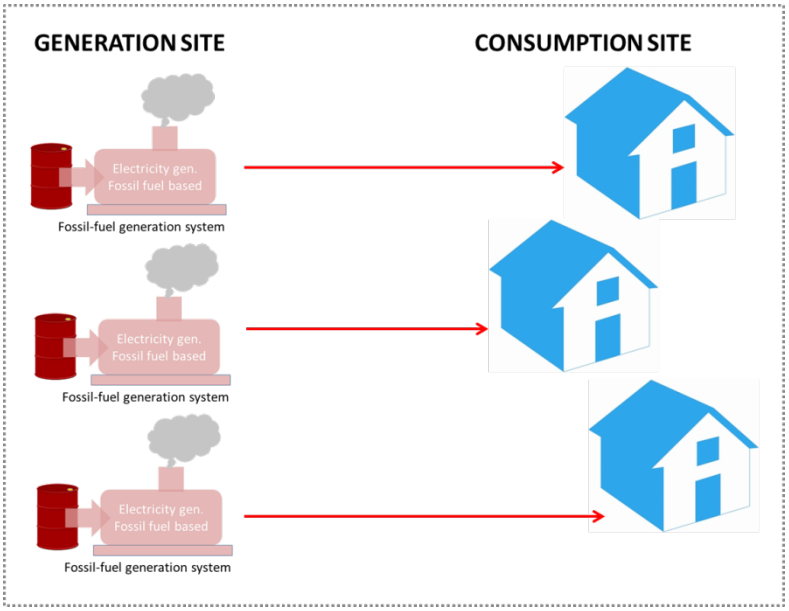
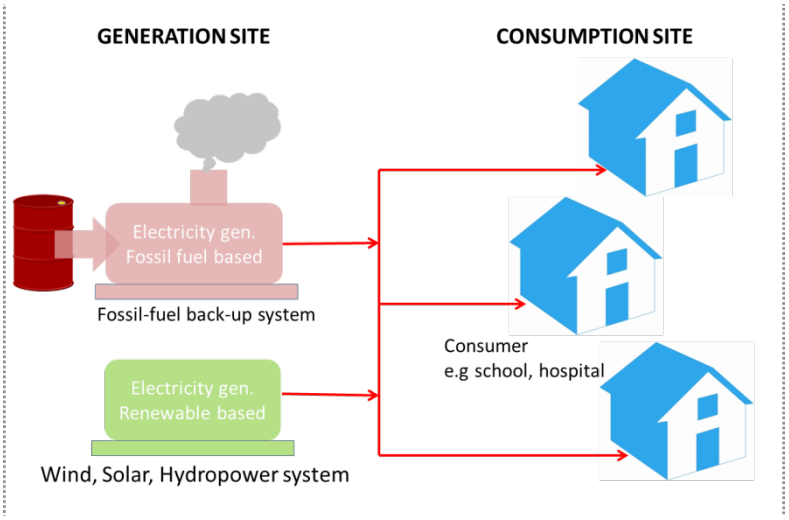


Figure 28. Project activity scenario for Intervention A—Mini Grid



Overview of emission reduction calculation:

The GHG emissions that have been avoided due to the NAMA intervention are calculated as follows.

Equation 3: $ER_y = \sum_{R=1}^{n} EG_{R,y} * EF_{CO2}$

Where:

Parameter	Description	Unit
ERy	Emission reductions over the time period y	tCO_2e
EGR,y	Electricity generated and delivered by renewable electricity generation system R to the consumer connected to the over the time y.	MWh
R	Renewable energy system, from which the electricity is generated and delivered to consumers connected to the mini grid over the time y.	-—
N	Total number of renewable energy systems, from which the electricity is generated and delivered to consumers connected to the mini grid over the time y.	-—
$EFCO_2$	Fossil fuel emission default factor = 1.0 t CO_2/MWh	tCO_2/MWh
Y	Period of time defined by the project participant	—

The details of the calculation approach will be given in the following sections.

The Baseline emission scenario

In absence of the NAMA Intervention A – Mini Grid including electricity generation systems as project activity, the generated electricity would rely on fossil fuel based off-grid electricity generation systems only.

A fossil fuel based off-grid electricity generation system, such as a diesel generator, emits carbon dioxide into the atmosphere due to the combustion of the fossil fuel within the motor which drives the generator to produce electricity. Therefore the generated electricity is directly linked to carbon dioxide (CO_2) emissions that can be expressed as the emission factor (tCO_2/MWh).

In keeping with the UNFCCC's "Small-scale Methodology AMS-I.L.: Electrification of rural communities using renewable energy Version 03.0", a default emission factor of 1.0 t CO_2/MWh will be applied for fossil fuel based generated and consumed electricity.

The baseline emissions are calculated as follows:

Equation 4: $BE_y = \left(\sum_{R=1}^{n} EG_{R,y} + \sum_{F=1}^{m} EG_{F-Baseline,y}\right) * EF_{CO2}$

Where:

Parameter	Description	Unit
BE_y	Baseline emissions over the time period y	tCO_2
$EG_{R,y}$	Electricity generated and delivered by renewable electricity generation system R to the consumer over the time y.	MWh
$EG_{F\text{-}Baseline,y}$	Electricity generated and delivered by fossil fuel based electricity generation system F to the consumer over the time y.	MWh
R	Renewable energy system, from which the electricity is generated and delivered to consumers connected to the mini grid over the time y.	—
F	Fossil fuel based energy system (back-up), from which the electricity is generated and delivered to consumers connected to the mini grid over the time y.	—

Parameter	Description	Unit
N	Total number of renewable energy systems, from which the electricity is generated and delivered to consumers connected to the mini grid over the time y.	—
M	Total number of fossil fuel based energy systems (back up), from which the electricity is generated and delivered to consumers connected to the mini grid over the time y.	—
EF_{CO2}	Fossil fuel emission default factor = 1.0 t CO_2/MWh	tCO_2/MWh
Y	Period of time defined by the project participant	—

The project activity emission scenario

The project activity is represented by a mini grid comprising electricity generation system(s) based on renewable sources and potentially a fossil fuel based back-up system(s). Fossil-fuel back-up systems are allowed. However, the share of electricity from renewable energies must be at least 75 per cent.

Therefore for each monitoring period y the following condition needs to apply.

Equation 5: $$\sum_{R=1}^{n} EG_{R,y} * 0.75 > \sum_{F=1}^{m} EG_{F-\mathrm{Pr}oject,y}$$

Where:

Parameter	Description	Unit
$EG_{R,y}$	Electricity generated and delivered by renewable electricity generation system R to the consumer connected to the mini grid over the time y.	MWh
$EG_{F\text{-}Project,y}$	Electricity generated and delivered by fossil fuel based electricity generation back-up system F to the consumer connected to the mini grid over the time y.	MWh
R	Renewable energy system, where the electricity generated and delivered to consumer connected to the mini grid over the time y.	—
F	Fossil fuel based energy system (back up), from which the electricity is generated and delivered to consumers connected to the mini grid over the time y	—
N	Total number of renewable energy systems, from which the electricity is generated and delivered to consumers connected to the mini grid over the time y.	—
M	Total number of fossil fuel based energy systems (back up), from which the electricity is generated and delivered to consumers connected to the mini grid over the time y.	—
Y	Period of time defined by the project participant	—

Project emissions

The electricity generated by renewable energy systems, which can be based on hydro, solar or wind as sources, causes no greenhouse gas emissions. Thus the project emissions are considered to be zero.

In the case where fossil fuel based electricity generation back-up system(s) have been installed and have generated and delivered electricity to the connected mini grid consumer, the project emissions are calculated as follows.

Equation 6: $$PE_y = \sum_{F=1}^{m} EG_{F-\mathrm{Pr}oject,y} * EF_{CO2}$$

Where:

Parameter	Description	Unit
$PE_{,y}$	Project emissions over the time period y	tCO_2
$EG_{F\text{-}Project,y}$	Electricity generated and delivered by fossil fuel based electricity generation back up system F to consumers connected to the mini grid over the time y.	MWh
EF_{CO2}	Fossil fuel emission default factor = 1.0 t CO_2/MWh	tCO_2/MWh

Emission Reductions

Emission reductions are the difference between the baseline emissions and project emissions after implementing the NAMA intervention mini grid with renewable energy system(s).

Based on the formula given under the baseline and project emission scenario:

Equation 7: $$ER_y = \left(\sum_{R=1}^{n} EG_{R,y} + \sum_{F=1}^{m} EG_{F-Baseline,y}\right) * EF_{CO2} - \sum_{F=1}^{m} EG_{F-\mathrm{Pr}oject,y} * EF_{CO2}$$

The electricity generated by the back-up fossil fuel based energy system(s) within the project scenario is equal to the baseline scenario, because in the absence of the NAMA intervention, using a mini grid, the consumer will also use fossil fuel based electricity as back-up. Therefore:

Equation 8: $$\sum_{F=1}^{m} EG_{F-Baseline,y} = \sum_{F=1}^{m} EG_{F-\mathrm{Pr}oject,y}$$

Thus the emission reduction formula can be simplified from:

Equation 9: $$ER_y = \sum_{R=1}^{n} EG_{R,y} * EF_{CO2} + \sum_{F=1}^{m} EG_{F-\mathrm{Pr}oject,y} * EF_{CO2} - \sum_{F=1}^{m} EG_{F-\mathrm{Pr}oject,y} * EF_{CO2}$$

to:

Equation 10: $$ER_y = \sum_{R=1}^{n} EG_{R,y} * EF_{CO2}$$

Conclusion

The emission reduction calculation due to the NAMA mini grid intervention requires the following steps.

i) Applicability criteria check:

The share of electricity from renewable energies must be at least 75 per cent.

Therefore for each monitoring period y:

Equation 11: $$\sum_{R=1}^{n} EG_{R,y} * 0.75 > \sum_{F=1}^{m} EG_{F-\mathrm{Pr}oject,y}$$

ii) Calculation of GHG emission reductions;

Equation12: $$ER_y = \sum_{R=1}^{n} EG_{R,y} * EF_{CO2}$$

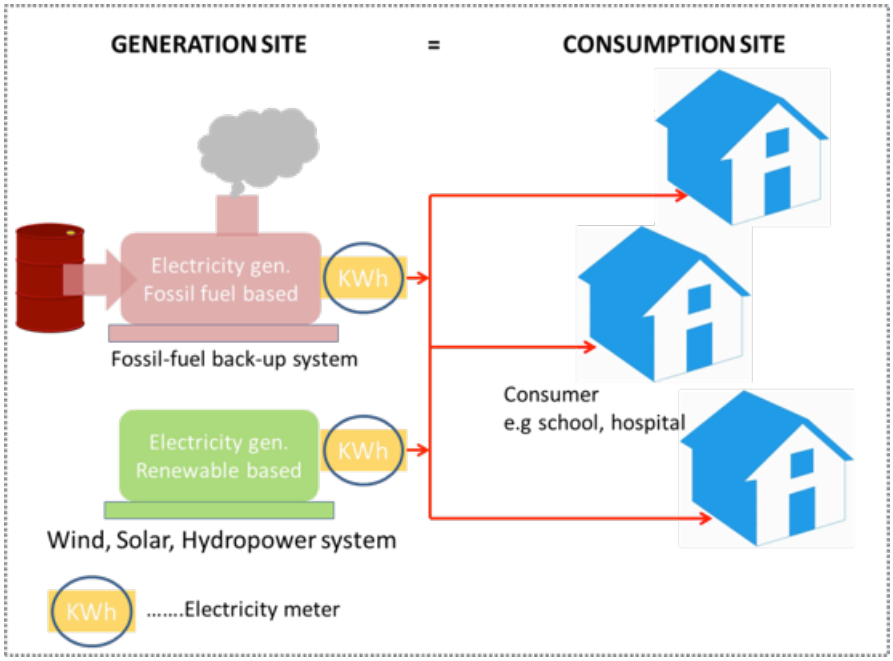
Where:

Parameter	Description	Unit
ER_y	Emission reductions over the time period y	tCO_2e
$EG_{R,y}$	Electricity generated and delivered by renewable electricity generation system R to the consumer connected to the mini grid over the time y.	MWh
$EG_{F\text{-}Project,y}$	Electricity generated and delivered by fossil fuel based electricity generation back-up system F to the consumer connected to the mini grid over the time y.	MWh
R	Renewable energy system, where the electricity generated and delivered to the consumer connected to the mini grid over the time y.	—
F	Fossil fuel based energy system (back up), from which the electricity is generated and delivered to consumers connected to the mini grid over the time y	—
N	Total number of renewable energy systems, from which the electricity is generated and delivered to consumers connected to the mini grid over the time y.	—
M	Total number of fossil fuel based energy systems (back up), from which the electricity is generated and delivered to consumers connected to the mini grid over the time y.	—
EF_{CO2}	Fossil fuel emission default factor = 1.0 tCO_2/MWh	tCO_2/MWh
Y	Period of time defined by the project participant	—

Measurement and monitoring

As all the electricity generated by the energy generation systems (R, F) will be consumed by consumers connected to the mini grid, only the generation site needs to be monitored via electricity meter.

Figure 29. Monitoring of generated and consumed electricity



Each electricity generation system R or F in the mini grid needs to be equipped with a calibrated electricity meter to monitor the generated electricity (EGR,y or EGF-Project,y) , supplied to the consumer of the mini grid over the time y.

Where:

Parameter	Description	Unit
EGR,y	Electricity generated and delivered by renewable electricity generation system R to the consumers connected to the mini grid over the time y.	MWh
EGF-Project,y	Electricity generated and delivered by fossil fuel based electricity generation back-up system F to the consumers connected to the mini grid over the time y.	MWh
R	Renewable energy system, where the electricity generated and delivered to the consumers connected to the mini grid over the time y.	—
F	Fossil fuel based energy system (back up), from which the electricity is generated and delivered to consumers connected to the mini grid over the time y	—

The reading of the electricity meter(s) should be recorded at least weekly by the duty operator on a data sheet. A consolidated data sheet should be compiled monthly and should be stored in a safe place together with the measurement instrument description, identification and calibration certificate.

In case of emergencies, when conditions prevent the responsible entity from monitoring electricity generation and consumption, the beginning and end of the emergency, the resumption of normal operations and the details of the emergency should be reported.

Table 36. Monitored GHG parameter—Intervention A

• Data/parameter	• GHG emissions reduced/avoided
• Unit	• tCO_2
• Description	• GHG emissions reduced/avoided by the mini grid
• Value	• 110tCO_2/year/mini grid
• Source of data	• Measured electricity generated by the mini grid, multiplied by the emission factor
• Measurement methods	• Each electricity generation system in the mini grid needs to be equipped with a calibrated electricity meter to monitor the generated electricity supplied to the consumer

Reporting

The NEEs should produce reports on achieved GHG emission reductions due to NAMA interventions regularly that include:

- description of the calculation approach used to quantify GHG emissions
- the measurement method applied and the parameters monitored
- the characteristics of the measurement instrument (type, installation date, identification, calibration)
- values of the monitored parameters including supporting evidence (measurement records)
- identification of any uncertainty or variability associated with quantifying GHG emissions.

Hard copies or soft copies of the reports should be kept at a safe centralized point and be archived.

10.1.3 GHG Emission Reductions under Intervention B – Energy Zones

GHG emission reductions under Intervention B in a given year y (ERB,y) are calculated by comparing actual (project) emissions (PEB,y) with the emissions under a baseline scenario (BEB,y).

Equation 2b: $ER_{B,y} = BE_{B,y} - PE_{B,y}$

Assumption

All the electricity generated under the NAMA intervention will be consumed, and thus the generated electricity is equal to the consumed electricity.

System boundary

The project activity is the Energy Zone intervention. Thus, the project boundary encompasses the Energy Zone, comprising electricity generation and consumption. The next two figures show the system boundary under the baseline and the project activity perspectives.

Figure 30. Baseline scenario for Intervention B—Energy Zone

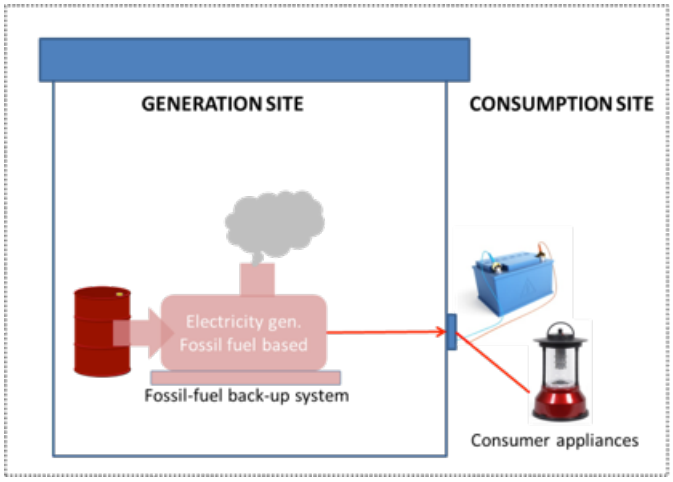
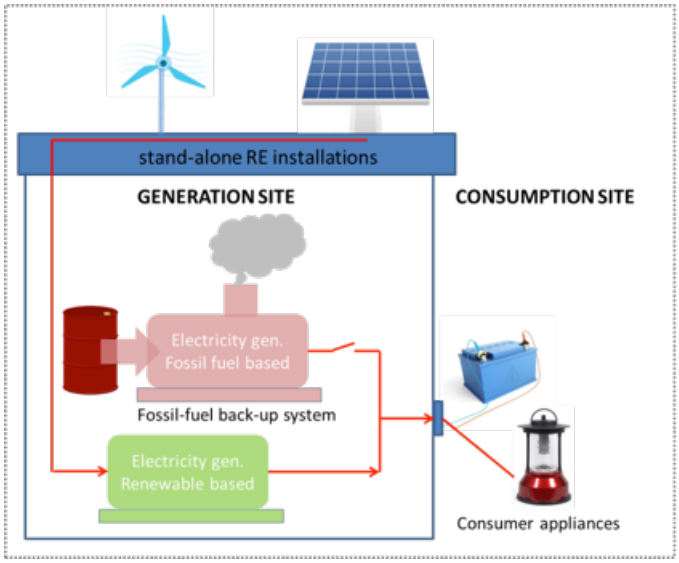


Figure 31. Project activity scenario for Intervention B—Energy Zone



Overview of the emission reduction calculation

The GHG emissions that have been avoided due to the NAMA intervention are calculated as follows.

$ER_y = EG_{R,y} * EF_{CO2}$

Where:

Parameter	Description	Unit
ER_y	Emission reductions over the time period y	tCO_2e
$EG_{R,y}$	Electricity, generated by energy zone renewable electricity generation system, supplied to consumer appliances or used for internal consumption within the Energy Zone over the time y	MWh
EF_{CO2}	Fossil fuel emission default factor = 1.0 t CO_2/MWh	tCO_2/MWh
Y	Period of time defined by the project participant	—

The details of the calculation approach will be given in the following chapters.

Baseline emission scenario

In the absence of the NAMA Intervention B – Energy Zone, the supply and consumption of electricity would rely on fossil fuel based off-grid electricity system(s) instead of renewable electricity generation stand-alone systems as a project activity.

A fossil fuel based off-grid electricity generation system, such as a diesel generator, emits carbon dioxide into the atmosphere due to the combustion of the fossil fuel within the motor which drives the generator to produce electricity. Therefore the generated electricity is directly linked to carbon dioxide (CO_2) emissions that can be expressed as the emission factor (tCO_2/MWh).

In keeping with the UNFCCC's "Small-scale Methodology AMS-I.L: Electrification of rural communities using renewable energy Version 03.0", a default emission factor of 1.0 t CO_2/MWh will be applied for fossil fuel based generated and consumed electricity.

The baseline emissions are calculated as follows.

$BE_y = (EG_{R,y} + EG_{F\text{-}Baseline,y}) * EF_{CO2}$

Where:

Parameter	Description	Unit
BE_y	Baseline emissions over the time period y	tCO_2
$EG_{R,y}$	Electricity, generated by the Energy Zone renewable electricity generation system, supplied to consumer appliances or used for internal consumption within the Energy Zone over the time y, which would otherwise be generated by a fossil fuel based electricity generation system in the absence of the NAMA intervention.	MWh
$EG_{F\text{-}Baseline,y}$	Electricity generated and delivered by a fossil fuel based electricity generation system	MWh
EF_{CO2}	Fossil fuel emission default factor = 1.0 t CO_2/MWh	tCO_2/MWh
Y	Period of time defined by the project participant	—

Project emission scenario

The project activity is represented by the Energy Zone renewable electricity generation system, which causes no greenhouse gas emissions, and potentially by a fossil fuel based back-up system within the Energy Zone.

The project emissions are calculated as follows:

$PE_{,y}=EG_{F\text{-}Project,y} * EF_{CO2}$

Where:

Parameter	Description	Unit
$PE_{,y}$	Project emissions over the time period y	tCO_2
$EG_{F\text{-}Project,y}$	Electricity, generated by fossil fuel based electricity generation back-up system within the Energy Zone, and supplied to consumer appliances or used for internal consumption within the Energy Zone over the time y.	MWh
EF_{CO2}	Fossil fuel emission default factor = 1.0 t CO_2/MWh	tCO_2/MWh

Emission Reductions

Emission reductions are the difference between the baseline emissions and project emissions after implementing the NAMA Intervention - Energy Zone based on renewable energy systems.

Therefore:

$ER_y=BE_y-PE_y$

Where:

Parameter	Description	Unit
ER_y	Emission reductions over the time period y	tCO_2
BE_y	Baseline emissions over the time period y	tCO_2
$PE_{,y}$	Project emissions over the time period y	tCO_2

Based on the formula given under the baseline and project emission scenarios,

$ER_y = (EG_{R,y} + EG_{F\text{-}Baseline,y}) * EF_{CO2} - EG_{F\text{-}Project,y} * EF_{CO2}$

The generated electricity of the fossil fuel based energy system back-up within the project scenario is equal to the baseline scenario, because in the absence of the NAMA intervention, the consumer will use fossil fuel based electricity as back-up.

Therefore:

$EG_{F\text{-}Baseline,y} = EG_{F\text{-}Project,y}$

Thus the emission reduction formula can be simplified from:

$ER_y = EG_{R,y} * EF_{CO2} + EG_{F\text{-}Project,y} * EF_{CO2} - EG_{F\text{-}Project,y} * EF_{CO2}$

to:

$ER_y = EG_{R,y} * EF_{CO2}$

Conclusion

The emission reduction, due to NAMA intervention Energy Zone is calculated as follows:

$ER_y = EG_{R,y} * EF_{CO2}$

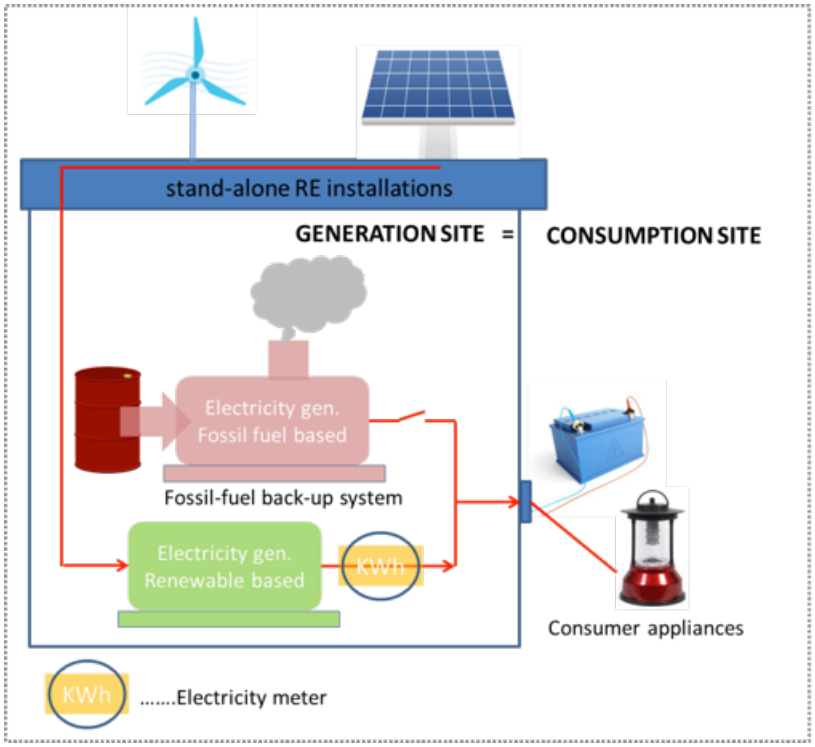
Where:

Parameter	Description	Unit
ER_y	Emission reductions over the time period y	tCO_2e
$EG_{R,y}$	Electricity, generated by Energy Zone renewable electricity generation system, supplied to consumer appliances or used for internal consumption within the Energy Zone over the time y	MWh
EF_{CO2}	Fossil fuel emission default factor = 1.0 t CO_2/MWh	tCO_2/MWh
Y	Period of time defined by the project participant	—

Measurement and monitoring

As all the electricity generated by the renewable energy generation system will be consumed within the Energy Zone only, the renewable generation site needs to be monitored via electricity meter.

Figure 32. Monitoring of generated and consumed electricity



The renewable energy generation system needs to be equipped with a calibrated electricity meter to monitor the generated electricity EGR,y, supplied to the consumer appliances or used for internal consumption within the Energy Zone over the time y.

Where:

Parameter	Description	Unit
$EG_{R,y}$	Electricity, generated by Energy Zone renewable electricity generation system, supplied to consumer appliances or used for internal consumption within the Energy Zone over the time y,	MWh

The reading of the electricity meter(s) should be recorded at least weekly by the duty operator on a data sheet. A consolidated data sheet should be compiled monthly and should be stored in a safe place together with the measurement instrument description, identification and calibration certificate.

In case of emergencies, when conditions prevent the responsible entity from monitoring electricity generation and consumption, the beginning and end of the emergency, the resumption of normal operations and the details of the emergency should be reported.

Table 37. Monitored GHG parameter—Intervention B

• Data/parameter	• GHG emissions reduced/avoided
• Unit	• tCO_2
• Description	• GHG emissions reduced/avoided by the mini grid
• Value	• 18 tCO_2/year/Energy Zone
• Source of data	• Measured electricity generated by the RE source of the Energy Zone, multiplied by the emission factor
• Measurement methods	• The electricity generation system of the Energy Zone needs to be equipped with a calibrated electricity meter to monitor the generated electricity

Reporting

The NEEs should produce reports on GHG emission reductions achieved due to NAMA interventions regularly that include:

- Description of the calculation approach used to quantify GHG emissions
- The measurement method applied and parameters monitored
- The characteristics of the measurement instrument (type, installation date, identification, calibration)
- Values of the monitored parameters including supporting evidence (measurement records)
- Identification of any uncertainty or variability associated with quantifying GHG emissions

Hard copies or soft copies of the reports should be kept at a safe centralized point and be archived.

Verification

Verification rules for NAMAs are usually based on the requirements of the NAMA funding agencies, as well as the host country requirements. Prior to developing domestic capacity for verification, it is recommended that the existing CDM auditors or ISO 14000 certification bodies with experience in rural electrification sector and a good understanding of Namibian local conditions be used. NAMA-specific verification rules should be developed in the future.

10.2 Measurement and Monitoring of Sustainable Development Benefits

In addition to GHG emissions, the MRV system for this NAMA will monitor the impact of the NAMA interventions on selected Sustainable Development (SD) indicators.

The selection of the SD indicators was done using the Sustainable Development Evaluation Tool (SD Tool) developed by UNDP (UNDP, 2014d). The SD Tool divides the SD indicators into four different domains: environment; social; growth and development; and economic.

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

10.2.1 Sustainable Development Benefits of Intervention A - Mini Grids

The indicators selected for **Intervention A – Mini Grids** in each of the four SD domains are as follows.

Table 38. SD indicators for Intervention A

Domain	Indicator	Selected (Yes/No)	Identified impacts	Monitored (Yes/ No)
Environment	Air pollution/quality	Yes	Reduce indoor pollution	No
	Water pollution/quality	No		No
	Soil pollution/quality	No		No
	Others (Noise/visibility)	No		No
	Biodiversity and Ecosystem balance	No		No
	Climate change adaptation and mitigation	No		No
Social	Health	Yes	Improvement of health and health care conditions	Yes
	Livelihood of poor, poverty alleviation, peace	Yes	Poverty reduction	Yes
	Affordability of electricity	No		No
	Access to sanitation and clean drinking water	No		No
	Food security (Access to land and sustainable agriculture)	No		No
	Quality of employment	No		No
	Time savings/time availability due to project	No		No
	No child labour	No		No

Domain	Indicator	Selected (Yes/No)	Identified impacts	Monitored (Yes/ No)
Growth and Development	Access to clean and sustainable energy	Yes	People less dependent on fossil fuels by having access to RE electricity	Yes
	Education	Yes	Better learning conditions	Yes
	Empowerment of women	No		No
	Access to sustainable technology	No		No
	Energy security	No		No
	Capacity-building	No		No
	Equality (quality of jobs given, job condition for men/women)	No		No
Economic	Income generation/expenditure reduction/balance of payments	Yes	Enhance productivity, efficiency, business opportunities	Yes
	Asset accumulation and investments	No		No
	Job creation (number of men and women employed)	Yes	Jobs creation	Yes

For the sake of simplicity, only a few indicators are to be monitored. The indicators selected are represented by the following parameters.

Table 39. Monitored SD parameters for Intervention A

No.	Parameter
1	Number of health clinics electrified
2	Number of households electrified
3	People with access to RE electricity
4	Number of schools electrified
5	New income-generating activity (businesses)
6	Number of new jobs (total)
7	Number of new jobs for women

Baseline SD scenario

Since the NAMA targets off-grid regions of the country, the baseline values are assumed to be zero in the ex ante estimation. However, in places where electricity sources, such as diesel generators, exist before project implementation, this will be incorporated into the monitoring process.

Table 40. Project SD scenario and targeted SD benefits—Intervention A

Nr.	Parameter	Unit	Baseline value	Project value (assumed for 1 MG)
1	Number of health clinics electrified	clinics	0	1
2	Number of households electrified	households	0	100
3	People with access to RE electricity	persons	0	600
4	Number of schools electrified	schools	0	1
5	New income-generating activity (businesses)	enterprises	0	5
6	Number of new jobs (total)	persons	0	2
7	Number of new jobs for women	women	0	1

Measurement, monitoring and reporting

The SD benefits achieved due to the NAMA interventions should be measured continuously, and reported by the responsible entity/intervention implementer regularly. Hard copies or soft copies of the reports should be kept at a safe centralized point, and be archived.

Table 41. Monitored SD parameters—Intervention A

Data/parameter	Number of health clinics electrified
Unit	Clinics
Description	Number of health clinics electrified by the mini grid
Value	1
Source of data	Intervention Implementer´s records
Measurement methods	Mini grid connection and electricity provision contract between the Intervention Implementer and the clinic
Data/parameter	Number of households electrified
Unit	Households
Description	Number of households electrified by the mini grid
Value	100
Source of data	Intervention Implementer´s records
Measurement methods	Mini grid connection and electricity provision contract between the Intervention Implementer and households

Data/parameter	People with access to RE electricity
Unit	Persons
Description	People with access to RE electricity due to the mini grid
Value	600
Source of data	Intervention Implementer´s records, in cooperation with the local constituency (local census, local survey)
Measurement methods	Counting

Data/parameter	Number of schools electrified
Unit	Schools
Description	Number of schools electrified by the mini grid
Value	1
Source of data	Intervention Implementer´s records
Measurement methods	Mini grid connection and electricity provision contract between the Intervention Implementer and the School

Data/parameter	New income-generating activity (enterprises)
Unit	Enterprises
Description	New income-generating activity (businesses) due to the mini grid
Value	5
Source of data	Intervention Implementer´s records, in cooperation with the local Constituency
Measurement methods	Mini grid connection and electricity provision contract between the Intervention Implementer and businesses, and survey undertaken in cooperation with the local Constituency

Data/parameter	Number of new jobs (total)
Unit	Persons
Description	Number of new jobs (total) due to the mini grid
Value	2
Source of data	NAMA Implementer´s records
Measurement methods	NAMA Implementer´s records on number of new employees generated internally within institution and reports on numbers of new employees from Intervention Implementers and other relevant stakeholders

Data/parameter	Number of new jobs for women
Unit	Women
Description	Number of new jobs for women due to the mini grid
Value	1
Source of data	NAMA Implementer´s records
Measurement methods	NAMA Implementer´s records on number of new employees generated internally within institution and reports on numbers of new employees from Intervention Implementers and other relevant stakeholders

Further details on the monitoring frequency and responsibilities can be found in the attached MS Excel sheet.

Verification

Verification is the periodic independent evaluation and ex post determination by a third party of monitored SD parameters and emission reductions as a result of a NAMA intervention.

Verification rules for NAMAs are usually based on the requirements of the NAMA funding agencies, as well as host country requirements. The selected body for third party verification should apply appropriate assessment methodologies and be familiar with local conditions and greenhouse gas emission protocols and standards.

Since the data sources for the monitored SD indicators are either local Constituencies or the entities responsible for implementing intervention activities in the country, the most suitable verification method is the on-site visit. Depending on the total number of implemented projects and the budgetary funding available, verification may take the form of a representative sample or cover all the projects. When samples are taken, the guidance on sampling in the SD Tool should be followed.

10.2.2 Sustainable Development Benefits of Intervention B – Energy Zones

The indicators selected for Intervention B – The Energy Zones in each of the four SD domains, are as follows.

Table 42. SD indicators for Intervention B

Domain	Indicator	Selected (Yes/No)	Identified impacts	Monitored (Yes/ No)
Environment	Air pollution/quality	No		No
	Water pollution/quality	No		No
	Soil pollution/quality	No		No
	Others (noise/visibility)	No		No
	Biodiversity and Ecosystem balance	No		No
	Climate change adaptation and mitigation	No		No
Social	Health			No
	Livelihood of poor, poverty alleviation, peace	Yes	Poverty reduction	Yes
	Affordability of electricity	No		No
	Access to sanitation and clean drinking water	No		No
	Food security (access to land and sustainable agriculture)	No		No
	Quality of employment	No		No
	Time savings/time availability due to project	No		No
	No child labour	No		No

Domain	Indicator	Selected (Yes/No)	Identified impacts	Monitored (Yes/ No)
Growth and Development	Access to clean and sustainable energy	Yes	People less dependent on fossil fuels, and having access to RE electricity	Yes
	Education	No		No
	Empowerment of women	Yes	Number of new women's enterprises in the EZ	Yes
	Access to sustainable technology	Yes	New sales points for RE and EE technologies	Yes
	Energy security	No		No
	Capacity-building	No		No
	Equality (quality of jobs given, job condition for men/women)	No		No
Economic	Income generation/expenditure reduction/balance of payments	Yes	Enhance productivity, efficiency, business opportunities and expenditure on electricity	Yes
	Asset accumulation and investments	No		No
	Job Creation (number of men and women employed)	No		No

For the sake of simplicity, only a few indicators are to be monitored. The indicators selected for Intervention B are represented by the following parameters.

Table 43. Monitored SD parameters for Intervention B

No.	Parameter
1	Households having access to electricity services
2	People with access to RE electricity services
3	Number of new women's enterprises in the EZ
4	New sales point for RE and EE technologies
5	New income-generating activity (enterprises)

Baseline SD scenario

Since the NAMA targets off-grid regions of the country, the baseline values are assumed to be zero in the ex-ante estimation. However, in situations when there will be an electricity source before project implementation (e.g. diesel generator), this will be regarded in the monitoring.

Table 44. Project SD scenario and targeted SD benefits—Intervention B

Nr.	Parameter	Unit	Baseline value	Project value (assumed for 1 MG)
1	Households having access to electricity services	households	0	30
2	People with access to RE electricity services	persons	0	180
3	Number of new women enterprises in the EZ	women's enterprises	0	1
4	New sales point for RE&EE technologies	EZs	0	1
5	New income-generating activity (business)	enterprises	0	2

Measurement, monitoring and reporting

The SD benefits achieved due to NAMA intervention should be measured continuously, and reported regularly by the responsible entity.

Hard copies or soft copies of the reports should be kept at a safe centralized point and be archived.

Table 45. Monitored SD parameters—Intervention B

Data/parameter	Households having access to electricity services
Unit	Households
Description	Households having access to electricity services due to Energy Zone
Value	30
Source of data	Data of the local Constituency
Measurement methods	Data of the local Constituency
Data/parameter	People with access to RE electricity services
Unit	Persons
Description	People with access to RE electricity services due to Energy Zone
Value	180
Source of data	Data of the local Constituency
Measurement methods	Data of the local Constituency

Data/parameter	Number of new women's enterprises in the EZ
Unit	Women's enterprises
Description	Number of new women's enterprises in the EZ
Value	1
Source of data	Intervention Implementer´s records
Measurement methods	Energy Zone´s rent/electricity provision contract with the entrepreneur

Data/parameter	New sales point for RE and EE technologies
Unit	EZs
Description	Number of new Energy Zones with new sales points for RE and EE technologies
Value	1
Source of data	NAMA Implementer´s records
Measurement methods	Counting

Data/parameter	New income-generating activity (enterprises)
Unit	Enterprises
Description	New income-generating activity (enterprises) in the EZ
Value	2
Source of data	Intervention Implementer´s records
Measurement methods	Energy Zone´s rent/electricity provision contract with the entrepreneur

Further details on monitoring frequency and responsibilities can be found in the attached MS Excel sheet.

Verification

Verification is the periodic independent evaluation and ex post determination by third party of monitored SD parameters and emission reductions as a result of a NAMA intervention.

Verification rules for NAMAs are usually based on the requirements of the NAMA funding agencies, as well as host country requirements. The selected body for third party verification should apply appropriate assessment methodologies and be familiar with local conditions and greenhouse gas emission protocols and standards.

Since the data sources for the monitored SD indicators are either local Constituencies or the entities responsible for implementing intervention activities in the country, the most suitable verification method is the on-site visit. Depending on the total number of implemented projects and the budgetary funding available, the verification may be take the form of a representative sample or cover all the projects.

10.3 MRV management

Responsibilities and process workflow

The main responsibility for the MRV system lies with the managing institution, which may delegate some of the tasks to the project implementers (PPPs, grid operators, equipment suppliers).

The process should unfold in the following sequence.

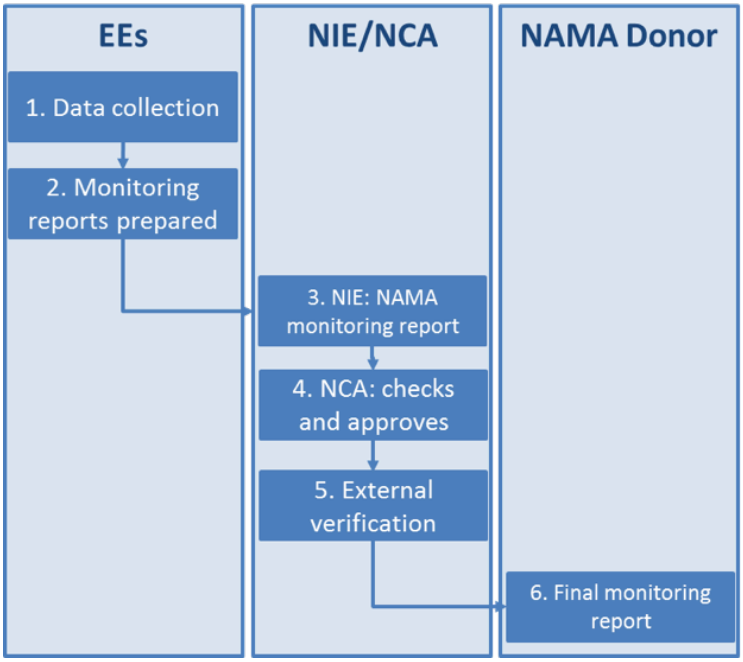
- The Executing Entities collect data according to the monitoring plan (as part of their approved application) and ensure they fulfill all related requirements such as record keeping and quality control.
- The Executing Entities report the monitoring results to the NIE in an annual report.
- The NIE collects all monitoring reports, combines them in a central monitoring database and summarizes the results in a NAMA monitoring report.

This report contains information on GHG emission reductions, progress in the SD indicators, and the financial performance of the NAMA activities.

- The NCA checks and approves the annual monitoring report.
- The NIE arranges for an external verification entity to verify the annual monitoring report.
- The final monitoring report together with the verification report of the external verifier is submitted to the NAMA donor(s).

The following figure visualizes the process.

Figure 33. MRV process



Reporting Forms

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

- Details about the venture;
- ESP contact details;
- description of the measuring system;
- data parameters measured;
- the default values applied;
- sampling plan details;
- calculations of emission reductions.

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

10.4 Verification

The goal of verification is to have an independent third party auditor ensure that the NAMA is operating as planned and that the measuring and reporting system is being implemented as planned. The 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[31] or under another accreditation system acceptable to the Government of Namibia and the NAMA donor(s).

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

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

31 Accredited entities are listed in CDM, 2015.

11 NAMA Implementation Plan

The implementation of the NAMA will be carried out in three main steps. As a first step, the institutional structure for NAMA implementation proposed in this document needs to be established. In parallel, funding from both international and national sources needs to be secured. Once these first two steps are finalized, implementation of the two interventions can start.

11.1 Establishment of the Institutional Structure for the NAMA Implementation

The institutional structure proposed in Chapter 8 of this document needs to be established as a basis for the interventions. The benefit of the proposed structure is that all the players already exist and no new body needs to be created. What needs to be confirmed are the roles each of the stakeholders will play.

It is suggested that implementation should start with an initial meeting of the NCCC, which is to act as a kind of supervisory board for the NAMA. As recommended, additional stakeholders (such as industry representatives) should be added to the NCCC to secure representation of key stakeholders relevant to the implementation of the NAMA. In this first meeting, the distribution of roles (NAMA Approver – NA, NAMA Coordinating Authority – NCA, NAMA Implementing Entity – NIE) as well as the distribution of tasks should be confirmed. If fine-tuning is necessary, this should be discussed in the NCCC.

11.2 Securing Donor Support and Domestic Funding

Early stage consultations with donors are essential for securing sufficient donor funding. Informal distribution of information about the NAMA concept should start immediately, even before a final version of the NAMA document is available. Formal approaches to potential donors should start as soon as the NAMA document is finalized.

Potential donors who already actively fund NAMAs are the German and British Governments through the NAMA support facility[32], the Global Environmental Facility (GEF)[33] through its executing agencies, the Green Climate Fund (GCF)[34], other EU governments as well as Japan through the Japan International Cooperation Agency (JICA)[35].

A secured budget for the domestically funded component always provides a strong signal to potential donors of a commitment to NAMA implementation. Therefore, it is essential that the domestic contribution to the interventions (co-funding of investment costs for mini grids in Intervention A, the costs of Energy Shops and co-funding of investment costs for Energy Zones in Intervention B) are secured within the state budget.

11.3 Implementation of Intervention A and Intervention B

Once the institutional structure is in place and funding (both national and international) is secured, implementation of the interventions can start. The process of implementation will be as described in detail in chapters 7.1.3 and 7.2.3. The following table gives a summary of the implementation timeline.

32 http://www.nama-facility.org/start.html.
33 http://www.thegef.org/gef/.
34 http://news.gcfund.org/.
35 http://www.jica.go.jp/english/index.html.

Table 46. Implementation timeline

	2015			2016				2017				2018			
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Establishment of Institutional Structure															
National and International Financing															
Intervention A															
Elaboration and promotion of tender															
Registration of potential NEEs															
Publication of tender															
Information activities and support															
Submission of proposals															
Evaluation of proposals															
Approval of proposals															
Disbursement of funds															
Intervention B															
Creation of long-list															
Information for potential Energy Zone partners															
Expression of Interest															
Evaluation of long-list															
Selection of Energy Zones															
Approval of proposals															
Disbursement of funds															

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