

GOVERNMENT OF THE REPUBLIC OF NAMIBIA

MINISTRY OF MINES AND ENERGY

OFF-GRID ELECTRIFICATION POLICY

FINAL DRAFT

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Foreword

Access to affordable energy services is a key requirement for socio-economic development. Providing electricity services plays a particularly important role in creating the conditions in which individuals as well as commercial and industrial actors meet their basic energy requirements while fulfilling their development aspirations.

The Government is cognisant that access to electricity has not yet been provided according to satisfactory levels. This is particularly prevalent in rural Namibia, where a lack of modern energy services in general and access to electricity services in particular is often significantly less developed than in and around urban centres. It is for this reason that the Government considers it critically important to spell out its intentions regarding off-grid electrification, and to invite private sector service providers to join the effort of delivering electricity services to all.

The Government recognises the abundance of local renewable energy resources that Namibia is so richly endowed with. This is important as off-grid electrification technologies using renewable energy resources have advanced considerably in the past few years. As a result, our indigenous energy resources can play an increasingly prominent role in delivering electricity services to communities as well as commercial and industrial activities that underpin the nation's development. By advancing off-grid electrification efforts, the Government supports and promotes its multiple efforts to uplift the standard of living of all Namibians, irrespective of whether they live in rural areas or are urban residents.

Accelerating national development to benefit all Namibians implies that the Government must increase the rate of access to reliable electricity services. This is what this Off-Grid Electrification Policy is about: using contemporary off-grid technologies in an innovative market environment to provide services that spur individual and national development, while benefitting from local resource endowments. In this way, the Government seeks to actively unlock growth and investment potentials, in close collaboration with utilities as well as private sector actors, to enable sustainable economic growth by achieving the upliftment and steady socio-economic advancement of the people of Namibia. It is my hope that this Policy will provide additional momentum in bringing meaningful development prospects to all Namibians.

.....
Thomas K. Alweendo, Member of Parliament
Minister of Mines and Energy

Acronyms and Abbreviations

AC	Alternating Current
DC	Direct Current
DSM	Demand Side Management
DX	Distribution (of electricity)
ECB	Electricity Control Board
ECC	Environmental Clearance Certificate
EDI	Electricity Distribution Industry
EE	Energy Efficiency
EIA	Environmental Impact Assessment
Electricity Act	Electricity Act, 2007 (Act No. 4 of 2007)
Electricity Bill	Electricity Bill, 2019
ESI	Electricity Supply Industry
ESMAP	Energy Sector Management Assistance Program
GRN	Government of Namibia
GX	Generation (of electricity)
HPP	Harambee Prosperity Plan
IEA	International Energy Agency
INDCs	Intended Nationally Determined Contributions
IPP	Independent Power Producer
LA	Local Authority
Minister	The Minister of Mines and Energy (<i>unless indicated otherwise</i>)
MoF	Ministry of Finance
MoHE	Ministry of Higher Education, Training and Innovation
MME	Ministry of Mines and Energy
MoPE	Ministry of Public Enterprises
MTF	Multi-tier Electricity Services Framework (<i>as introduced in this Policy</i>)
MURD	Ministry of Urban and Rural Development
MW	Mega-Watt
MWT	Ministry of Works and Transport
NamPower	Namibia Power Corporation
NEF	National Energy Fund
NEI	Namibia Energy Institute
NEP	National Energy Policy
NERA	Namibia Energy Regulatory Authority
NIRP	National Integrated Resource Plan
NPC	National Planning Commission
NQA	Namibia Qualifications Authority
NSC	Namibian Standards Council
NSI	Namibian Standards Institution
NTA	Namibia Training Authority
NUST	Namibia University of Science and Technology
OGEMP	Off-Grid Energisation Master Plan
OMAs	Offices, Ministries and Agencies of the Government of Namibia
PPA	Power Purchase Agreement
PPP	Private-Public Partnership
QoS	Quality of Supply Standard

RC	Regional Council
RE	Renewable Energy
RED	Regional Electricity Distributor
REFIT	Renewable Energy Feed-in-Tariff
REDMP	Rural Electricity Distribution Master Plan
REP	Renewable Energy Policy
SADC	Southern African Development Community
SAPP	Southern African Power Pool
SDG	Sustainable Development Goals
SHS	Solar Home System
SME	Small and Medium Enterprise
SRF	Solar Revolving Fund
TX	Transmission (of electricity)
UN	United Nations
UNAM	University of Namibia
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
Utility	Licensed operator active in the Namibian electricity industry
VTC	Vocational Training Centre

Glossary and Definitions

Term	Definition
access to modern energy *	A household has access to at least one type of electricity service, as well as clean cooking facilities.
affordable energy *	For households: using a reasonable amount of modern energy at a cost which is affordable to the household. For businesses and industries: using an efficient amount of energy at a cost that can be reasonably recovered from customers without rendering the business uncompetitive.
clean energy *	Energy that does not pollute the environment when used.
hybrid power system	The combination of two or more power supply sources (e.g. a solar PV system and diesel back-up generator), which usually supply electricity to a system such as a micro- or mini-grid.
home electricity supply system	An autonomous electrical power system that supplies a single end-user (e.g. a household).
independent power producer *	A generation licence holder which is a separate legal entity from any public electricity utility, and which is not wholly owned by a public electricity utility.
micro-grid	Small mini-grid with no medium-voltage distribution.
mini-grid	An autonomous electrical power system that supplies multiple users (which supplies a fully grid-code compliant medium- and/or low-voltage distribution system, with consumption meters at each supply point).
modern energy *	In the context of access to energy, <i>modern energy</i> is used to describe energy carriers that do not involve the burning of non-sustainable supplies of wood, the use of candles or paraffin, or the reliance on non-reusable batteries.
off-grid	An electricity end-user, supply system or distribution network not connected to the national electricity grid (irrespective of location or proximity to the grid).
Regulator	The authority responsible for the regulation of the country's electricity industry (currently the Electricity Control Board).
renewable energy *	Renewable energy is energy that is derived from resources or processes that are naturally replenished on a human timescale. Solar, wind, hydropower, bioenergy, geothermal and ocean/wave power are examples of renewable energy sources.
single end-user	A household or an institutional, industrial or commercial electricity end-user.
stand-alone power supply system	An autonomous electrical power system that supplies one or several end-users.
sustainable development *	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
universal access to modern energy *	Every household has the opportunity to use at least one type of modern energy.

* Definitions as provided in the National Energy Policy, 2017

Executive Summary

Purpose

This Policy expresses the Government of Namibia's intent regarding national off-grid electrification and creating access to electricity services using contemporary off-grid technologies.

Process

In late 2018, the Ministry of Mines and Energy (MME) requested the Electricity Control Board (ECB) to manage the development of the Off-Grid Electrification Policy on its behalf. The ECB tendered, selected and appointed a specialist consulting team to assist with the drafting of the policy document and coordination of stakeholder engagements.

The process that led to this Policy included two phases: Phase 1 entailed an in-depth assessment of the requirements for off-grid electrification in Namibia, including an assessment of current policy and regulatory gaps, and concluded with a national stakeholder workshop. Phase 2 entailed the development of the present policy document. It included a second national workshop where stakeholders discussed the draft policy and provided their inputs, which resulted in the final Policy.

Access to Electricity Services

An estimated 45% of the country's citizens have access to electricity services. These are mostly supplied by way of a connection to the national electricity distribution grid. In urban areas the electrification rate amounts to about 71%, while in rural areas it amounts to about 19%.

Key Electricity Sector Stakeholders

The Ministry of Mines and Energy (MME) is responsible for all energy matters in the country and is the principal custodian of the Off-Grid Electrification Policy. The Ministry of Finance (MoF) allocates the MME's annual electrification budget and is responsible for fiscal incentives and Namibia's investment policy. The Ministry of Environment and Tourism's (MET) responsibilities relate to ensuring that off-grid activities meet national environmental standards. The MET also issues environmental clearances, where these are required, and monitors compliance with environmental regulations. The National Planning Commission (NPC) is tasked with planning and monitoring the course of national development, which includes energy-related projects.

The Electricity Control Board (ECB) is the statutory regulator for the electricity sector. It is responsible for the sector's technical and economic regulation, which includes administering the licensing of activities and recommending the issuance of licences to the Minister of the MME.

The Namibia Power Corporation (NamPower) is the country's state-owned power utility. It owns and operates the major power stations and the transmission grid, and is involved in the distribution of electricity where other distributors are unavailable.

Electricity distributors are licensed to distribute and supply electricity. The most prominent among these are the three existing Regional Electricity Distribution companies (i.e. NORED, CENORED and Erongo RED), as well as the City of Windhoek, Oshakati Premier Electric and NamPower Distribution.

Other entities, including local authorities, regional councils, farmer electricity utilities and various commercial and residential private sector owned distributors, are also active in distributing electricity to end-users.

The Off-grid Electrification Policy Framework

The Off-grid Electrification Policy's vision is to contribute to the creation of universal access to electricity services throughout Namibia.

Its mission is to create enabling conditions for existing and new electricity service providers to enhance access to electricity by providing off-grid electrification services to end-users.

Its objectives include creating investment certainty; ensuring technology neutrality; creating a suitable regulatory framework and applying light-handed regulation; promoting business development; fostering collaboration; ensuring clarity and purpose and focus; and promoting communication between all relevant stakeholders and ensuring process transparency.

Its strategies include creating a system of foundational statements; defining the roles and responsibilities of all key actors; supporting electricity service providers; enacting requisite enabling mechanisms; incentivising off-grid business models; creating attractive investment conditions; and defining the institutional and governance modalities and setting framework conditions for off-grid tariffs.

Multi-tier Electricity Service Framework

This Policy introduces a multi-tier electricity service framework (MTF) that classifies the provision of electricity services using off-grid technologies. The MTF is based on distinct electricity service tiers whereby Tier 1 corresponds to the most basic provision of electricity services. In the case of the highest service level (i.e. Tier 5), the availability, capacity and energy provided is equivalent to a connection to the main electricity grid.

The MME regards Tier 3 as the minimum service specification for all programmes and projects initiated and/or funded by the Government. Tier 1 and Tier 2 services may be offered to end-users who want to minimise their energy-related expenditure. However, in order to be officially recognised as having access to electricity, the Government considers the MTF's Tier 3 as the minimum service level. Tier 3 provides electricity for lighting, the use of low power electrical appliances and the operation of a small refrigerator.

Policy Statements

The Off-grid Electrification Policy includes seven core themes, which are as follows:

1. **Foundational Statements**, to guide national off-grid electrification activities and efforts;
2. **Enabling Conditions and Mechanisms**, to benefit from advances in decentralised electricity generation, distribution and storage technologies to enhance off-grid access to electricity;
3. **Off-grid Electrification Businesses and Business Models**, to ensure that suitable off-grid business models are developed and enacted to accelerate off-grid electrification efforts throughout Namibia;

4. **Funding, Incentives and Investor-friendly Conditions**, to create conducive investment conditions to secure private investments and development- and climate-related funding for off-grid electrification efforts in addition to Government funding;
5. **Institutional, Governance and Ownership Considerations**, to optimise institutional, regulatory and governance provisions and the environment to accelerate the delivery of off-grid electrification services throughout Namibia, which are informed by best practice ownership modalities;
6. **Tariffs, Cost Recovery and Subsidies**, to ensure that a suite of off-grid electricity service tariffs and subsidy mechanisms are devised that balance end-user needs with those of viable providers and committed investors; and
7. **Grid Encroachment and the Compatibility of Grid and Off-grid Systems**, to provide assurance to off-grid investors regarding the encroachment of the grid, and to ensure the compatibility of grid and off-grid systems.

Implementation Framework

The Policy concludes with a high-level framework within which the Policy is to be implemented. The Implementation Framework describes the main roles of the institutional entities responsible for Policy implementation, and it provides comments based on the legal and regulatory provisions that underpin the Government's role in future electrification efforts and activities.

The Implementation Framework includes a high-level summary of the main responsibilities relating to the mobilisation of resources required for the implementation of this Policy. It provides guidance for the monitoring and evaluation of projects that are undertaken to implement this Policy; it provides a description of the main advocacy and dissemination responsibilities associated with this Policy; and it includes an implementation action plan.

1 Introduction

This document is **Namibia's Off-Grid Electrification Policy**. It communicates the Government's intent, direction and undertakings regarding the structured introduction, development and governance of off-grid electrification services and technologies in Namibia.

1.1 Rationale and Structure of this Policy

1.1.1 Rationale

This Policy expresses the Government's intent to broaden the provision of and access to electricity services, focusing specifically on off-grid technologies. The Government will also facilitate the development of a regulatory framework for the promotion, provision and quality of off-grid electricity services, where required, by means of financing, licensing, tariff determination, standards, technical regulations, and others.

1.1.2 Policy Development Process

In support of Government processes, the Regulator managed the policy development process on behalf of the Ministry of Mines and Energy, which resulted in this Off-Grid Electrification Policy.

The process constituted two phases: Phase 1 entailed an in-depth assessment of the requirements for off-grid electrification in Namibia, which includes a gap and barrier analysis. It culminated in a national stakeholder workshop. Phase 2 entailed the development of the present policy document and included a final national stakeholder workshop at which the draft Policy was discussed and stakeholder inputs were secured, which led to the final version of the Policy, as reflected in this document.

1.1.3 Structure of this Policy

The subsequent content of this document is structured as follows:

- **Section 1** introduces the context in which the Off-Grid Electrification Policy is applied.
- **Section 2** describes the policy framework underpinning the Off-Grid Electrification Policy.
- **Section 3** presents the Off-Grid Electrification Policy's main policy statements.
- **Section 4** presents the implementation framework for the Off-Grid Electrification Policy.

1.2 Context

1.2.1 National Context

Namibia's national development ambitions are guided by Vision 2030, which was adopted in 2004. Vision 2030 foresees the provision of secure and affordable energy to the country's developing economy and its people; it provides the overall long-term development goals for the country; and it subscribes to the principle of sustainable development. Specifically, Vision 2030 foresees **"a prosperous and industrialised Namibia, developed by her human resources, enjoying peace, harmony and political stability"**.

The Government's medium-term goals and strategies are expressed in **National Development Plans (NDPs)**, which are formulated in accordance with Vision 2030 and revised every five years. Regarding energy-related developments, the national development framework described above has the following implications:

1. An industrialised Namibia, as per Vision 2030, can only be realised provided secure, sufficient and economically priced energy supplies are and remain available. This ambition has definite repercussions and implications for the country's on-going electrification and creation of access to modern energy services for its citizens, commerce and industry.
2. Economic and social upliftment of the people of Namibia includes access to modern energy services, at fair and affordable prices. Without such access, the people of Namibia cannot realise their personal development ambitions. Again, it is the country's energy industry that must ensure that the energy resources are available to power the nation and her people.

In 2015, Namibia signed the Paris Climate Agreement, codifying its **intended nationally determined contributions (INDCs)** to the UNFCCC. Namibia's INDCs commit the country to increase the share of renewables in electricity production to 70%, to increase energy efficiency and demand side management (DSM) measures, to implement mass transport, and to introduce car and freight pooling.

In 2016, Namibia released the **Harambee Prosperity Plan (HPP)**, which sets out the country's short-term development priorities, which includes short-term energy access targets.

The National Energy Policy (NEP) of 2017 foresees an increase in local, decentralised electricity generation using renewable resources by means of leveraging Namibia's natural resource endowments to increase energy self-sufficiency and promote the availability of affordable electricity for Namibia's economy and people. It also expresses the ambition of creating access to at least one form of electricity service for all Namibians.

The National Renewable Energy Policy (REP) of 2017 advocates the thrust towards increasing the renewable energy contribution to the country's electricity mix. Renewable energy generation technologies, such as those used for decentralised electricity generation and off-grid applications, have the potential to contribute to reaching the NEP goal of universal access to electricity in Namibia.

The Independent Power Producer Policy (IPPP) of 2018 foresees significant investment in renewable energy IPPs, in alignment with the National Integrated Resource Plan (NIRP). The IPPP foresees that IPPs will contribute to off-grid investments and the advancement of rural electrification.

In keeping with the key policies identified above, this **Off-Grid Electrification Policy** is informed by the requirements of sustainable development, where social, economic and environmental considerations must set the direction and actions towards enhancing access to electricity services for all Namibians.

1.2.2 Access to Electricity Services

Approximately 45% of the country's citizens have access to electricity services, which are mostly supplied through connections to the national electricity distribution grid. The urban rate of access to grid-supplied electricity is approximately 71%, which is much higher than in rural areas where only approximately 19% have such benefits.

1.2.3 Key Stakeholders in the Namibian Electricity Services Sector

The following key stakeholders are active in their respective responsibilities within Namibia's electricity services sector:

Ministry of Mines and Energy (MME)

The Ministry of Mines and Energy (MME) is responsible for all energy matters in the country, and it is the principal custodian of the Off-Grid Electrification Policy.

The ministry's mandate, as expressed in the MME's strategic plan for 2012-2017, is as follows:

"The Ministry of Mines and Energy was constitutionally established to take custody of Namibia's rich endowment of mineral and energy resources and create an environment in which the mineral, energy, and geological resources contribute to the country's socio-economic development."

The ministry's mission statement affirms that the MME is:

"To promote, facilitate, regulate and monitor the responsible development and sustainable utilisation of Namibia's mineral, geological and energy resources; through competent staff, innovation, research, and stakeholder collaboration in a conducive environment for the benefit of all Namibians."

Ministry of Finance (MoF)

The MoF allocates the MME's annual electrification budget, and designs and implements fiscal incentives. The MoF also provides input on electricity sector subsidies and is responsible for the investment policy.

Ministry of Environment and Tourism (MET)

The MET's responsibilities relate to ensuring that off-grid activities meet set environmental standards, issuing environmental clearances (where required), and monitoring compliance with environmental regulations.

Electricity Control Board (ECB – the Regulator)

The Electricity Control Board (ECB) is the statutory regulator for the electricity sector; established in 2000 under the Electricity Act of 2000, which was replaced by an updated Act in 2007. It is funded by the 'ECB Levy', which is imposed on electricity supply.

The Regulator currently regulates the technical and economic aspects of the electricity sector. It administers licensing of sector activities and makes recommendations to the Minister of the MME regarding the issuance of licences, while the Minister approves the licences.

In future, it is anticipated that the Regulator could facilitate the implementation of rural electrification projects. In addition, the Regulator could also formulate and implement detailed rules on economic and technical matters, and quality of supply standards (QoSS), grid interconnection requirements and related standards, and other aspects of rural electrification, which includes off-grid electrification. This can also include the formulation and implementation of economic regulations as they pertain to tariffs, concessions, power purchase agreements and related matters; and the monitoring of the legal regulations (licensing and registration requirements). As the central authority within the Electricity Supply Industry (ESI), the Regulator's role as industry mediator will most likely be preserved, as will the provision of advisory functions to entities operating in the sector.

Namibia Power Corporation (NamPower)

The Namibia Power Corporation (NamPower) is Namibia's major state-owned electricity utility. It is registered as a private limited liability company under the Companies Act, with the Government as its sole shareholder.

NamPower is responsible for generation, transmission, trading, and import and export of electricity. NamPower owns and operates the major power stations in the country and the transmission grid. NamPower is also involved in the distribution of electricity where other suitable distributors are unavailable. However, the utility's distribution activities remain limited and it is the intention that NamPower withdraws from the country's electricity distribution sector as soon as competent replacements are operational.

Electricity Distributors

Electricity distributors are licensed to distribute and supply electricity. Most prominent among these are the three existing Regional Electricity Distributors (NORED, CENORED and Erongo RED), the City of Windhoek, Oshakati Premier Electric and NamPower Distribution. Other local authorities and regional councils in the Khomas, Omaheke, Hardap and //Karas Regions also distribute electricity. In addition, several farmer electricity utilities and other commercial/residential private sector owned distributors are also active in Namibia.

Generally, electricity distributors could form partnerships between Government institutions, public utilities, private companies as well as new actors in the off-grid electrification space, which would then expand their roles into the management of off-grid activities within their respective licence areas.

Local, Regional and Traditional Authorities

The main functions of these authorities, in the ambit of off-grid electrification, include the following:

- Assist in the identification of off-grid target areas
- Authorise land use
- Award building contracts
- Award resource utilisation permits (e.g. water rights)
- Promote off-grid programmes
- Facilitate contact with electricity users
- Facilitate community engagement

Ministry of Works and Transport (MWT)

The MWT is responsible for the maintenance of off-grid systems that operate at various Government institutions.

National Planning Commission (NPC)

The mandate of the National Planning Commission (NPC) is derived from Article 129 of the Constitution of the Republic of Namibia, as well as the National Planning Commission Act, 2013 (Act No. 2 of 2013). The overarching mandate of the NPC is to "plan and spearhead the course of national development."

Specifically, the functions of the NPC are as follows:

- Identifying Namibia's socio-economic development priorities
- Formulating short-term, medium-term and long-term national development plans in consultation with regional councils
- Developing monitoring and evaluation mechanisms to ensure effective implementation of the national development plans
- Evaluating the effectiveness of the Government's socio-economic policies
- Coordinating the development of Government socio-economic policies to ensure consistency
- Mobilising, managing, and coordinating international development cooperation

Private Sector Actors

Private sector actors are the main service and technology providers for investments in off-grid electrification, and they are the principal agents for the introduction of technologies, innovations and system efficiencies throughout the sector. Private sector actors can fulfil several roles in off-grid electrification, spanning from developers and operators (including concession operators) to financial investment/funding agencies.

Namibian Standards Institution (NSI)

The NSI was established in terms of the Standards Act, 2005 (Act No. 18 of 2005) and is governed by the Namibian Standards Council (NSC). Its mandate is to carry out the following functions in relation to off-grid electrification:

- Manage and coordinate the implementation of the National Quality Policy and promote quality in society
- Develop, adopt and publish Namibian standards in compliance with World Trade Organisation requirements
- Certify products and organisations' management systems through the Marks of Conformity

Namibia Energy Institute (NEI)

The NEI is a national institute of the Government and is housed at the Namibia University of Science and Technology (NUST). The NEI seeks to contribute to capacity in the field of energy, including energy efficiency and different energy technologies, and to contribute to Namibia's industrialisation by linking energy research, technology, policy, and education to the needs of industry, in support of national socio-economic development imperatives, initiatives and programmes. The NEI has four centres: Centre for Renewable Energy and Energy Efficiency, Centre for Electricity Supply, Centre for Petroleum (Oil and Gas), and the Centre for Nuclear Sciences.

Tertiary Education Institutions

Tertiary education institutions should offer study and vocational training courses relevant to off-grid electricity provision and the electricity industry. These efforts should include setting and implementing educational programmes, standards and accreditation, and ensuring the promotion and focus on the development of appropriate skills.

Namibia Training Authority (NTA) and Namibia Qualifications Authority (NQA)

The NTA and NQA should support national study and training efforts by integrating these into the national training and qualification frameworks, thereby assuring the quality of skills and qualifications.

2 Policy Framework

2.1 Guiding Principles

The Off-Grid Electrification Policy is an expression of the Government's intent to recognise, commit to, promote and support the provision of modern energy services throughout Namibia by means of, amongst others, off-grid applications.

Cognisant of the multitude of challenges associated with the provision of electricity services to the entire country, it is the Government's aspiration to create enabling conditions for existing as well as new electricity service providers in order to enhance access to electricity services throughout Namibia.

2.2 Overall Policy Direction

The overall direction of the Off-Grid Electrification Policy is **to create sustainable access to electricity services through off-grid technologies, for the benefit of end-users and the country's development.**

2.2.1 Vision

The vision of the Off-Grid Electrification Policy is **to contribute to the creation of universal access to electricity services throughout Namibia.**

2.2.2 Mission

The mission of the Off-Grid Electrification Policy is **to create enabling conditions for existing and new electricity service providers to enhance access to electricity by providing off-grid electrification services to end-users.**

2.2.3 Objectives

The objectives of the Off-Grid Electrification Policy are to:

- i. promote long-term investment certainty, predictability and sector-wide growth, underpinned by national needs, aspirations, capabilities and local resource endowments;
- ii. balance technology neutrality in off-grid electrification programmes and projects with other requirements, as expressed in the National Energy Policy and National Renewable Energy Policy, as is relevant;
- iii. establish an enabling regulatory framework for off-grid electrification programmes and projects by developing and implementing the required legal and institutional changes for the implementation of light-handed, cost-effective and principle-centred regulations, licensing, tariffs and technical standards;
- iv. develop and apply light-handed regulations and processes for project developers, operators, investors and end-users;
- v. initiate, support and facilitate existing and new initiatives and business models for the enhanced delivery of modern off-grid energy services;

- vi. foster collaboration between established and new electricity providers as well as off-grid end-users in order to enhance access to electricity services;
- vii. enhance the clarity of the purposes and focuses of Government-initiated national off-grid electrification programmes, projects and initiatives;
- viii. create socially acceptable off-grid service tariffs and charges that balance the upfront and ongoing costs of providing services with the end-users' ability to pay; and
- ix. ensure that off-grid electrification initiatives are well-communicated, follow transparency of process, and are readily and speedily implemented.

2.2.4 Prerequisites

The Off-Grid Electrification Policy assumes that:

- i. the Government is and will remain **committed to enhancing access to modern energy services** by means of the national electricity grid as well as the provision of suitable off-grid electrification services;
- ii. established and new electricity providers are willing and able to **contribute to planning, funding and/or co-funding and implementing national off-grid electrification programmes and projects**; and
- iii. electricity end-users recognise the value of having **access to modern energy services that are delivered by means of off-grid electrification applications** at affordable tariffs where the provision of grid services is not viable.

2.2.5 Strategies

The strategies of the Off-Grid Electrification Policy are to:

- i. provide a consistent and adequate system of foundational statements to anchor the Policy, and to motivate and guide future national off-grid electrification efforts throughout the country;
- ii. outline the roles and responsibilities of all key actors that participate in national electrification efforts;
- iii. enable, incentivise and support existing and new electricity service providers to create access to modern energy services for all;
- iv. formulate and enact the requisite enabling mechanisms to benefit from advances in decentralised electricity generation and storage technologies;
- v. identify, promote and incentivise the development of suitable off-grid business models to accelerate the delivery of modern energy services to all;
- vi. create attractive and transparent investment conditions to secure private investment funds as well as development- and climate-related funding that will enhance access to modern energy services throughout Namibia;
- vii. define institutional and governance modalities and conditions through which access to modern energy services can be enhanced and the productive use of energy can be increased; and
- viii. provide the high-level framework for the tariffs of modern off-grid electrification services.

2.3 Access to Modern Energy Services through Electrification

Namibia's electricity supply industry (ESI) has historically used a definition for access to electricity that focuses on access to grid or grid-equivalent electricity services only. Although off-grid power supply systems such as mini-grids and other stand-alone systems have been used, they have not been properly accounted for when referring to 'access to electricity'.

Increasing access to electricity in rural areas has been the primary remit of the Ministry of Mines and Energy, under the Rural Electricity Distribution Master Plans (REDMPs). The MME commissioned the country's first REDMP in 2000, which was updated and extended in the versions that were prepared in 2005 and 2010. The REDMPs are grid-based electrification master plans. They define 'household access' in to-be-electrified localities as being within low voltage reach of a medium voltage transformation point (i.e. generally within 500m of the nearest transformation point). To have 'access' under this definition means that a household does not actually have to be connected to the grid, as it was assumed that such connection could be made using the resources of the local supply authority and/or the to-be-connected household.

The REDMPs are driven by the Government of Namibia's (GRN) aspiration to provide grid electricity to Government infrastructure, which includes schools, health facilities and offices, noting that the provision of electricity to households is not the primary focus. This is reflected in the prioritisation mechanisms underpinning the plans. While households were initially included and connected when within a radius of 500m from any transformation point, this practice was later suspended, owing to the expectation that REDs were to connect households and private businesses once the Government had provided the backbone infrastructure required to electrify Government infrastructure.

The above illustrates that Namibia's approaches to quantify access to electricity and create the required infrastructure to rapidly and flexibly provide household access to electricity services are neither aligned with contemporary international practices nor the Government's vision of enhancing access to electricity services.

2.4 Off-grid Electrification

Many of Namibia's un-electrified areas are characterised by low population densities and/or highly distributed settlement patterns. This implies that it is often neither technically nor economically justifiable to provide access to modern energy services by means of conventional grid electrification approaches. It is therefore imperative to advance electrification efforts other than those provided by the national electricity grid.

This Policy interprets the term 'off-grid electrification' to mean the provision of electrification services to both individual and institutional end-users as well as select geographical areas, using autonomous electricity supply systems in the form of either mini-grids or other stand-alone electricity supply systems.

This Policy therefore interprets the term 'off-grid' in the sense of an electricity end-user, supply system or distribution network not connected to the national electricity grid, irrespective of the location or proximity to the grid.

The provision of off-grid electrification services is not limited to rural areas and may be used:

1. in areas where low end-user densities and/or the remoteness from the grid render a grid electricity supply ineffective and/or too costly;
2. where the arrival of the grid is expected to be delayed for a long time;

3. where a lack of land planning prevents the development of grid infrastructure (e.g. in informal areas within local authority jurisdictions); and
4. in other applications where off-grid electricity supplies offer an efficient and effective option to provide access to electricity.

What these electricity supply systems used to provide off-grid electrification services have in common is that they are not connected to the national electricity grid. The sub-sections below provide brief introductions to the salient features of the off-grid electrification technologies included in this Policy, and their relevance with regard to the provision of electricity services to end-users.

2.4.1 Off-grid Electrification Technology: Mini-grids

Mini-grids are stand-alone electricity supply systems that feed local electricity distribution networks (at low voltage (up to 1 kV) and/or medium voltage (between 1kV and 44kV)) in order to provide electrical energy to multiple end-users. They are autonomous supply and distribution systems which are not connected to the main electricity grid. This Policy does not distinguish between the so-called micro- and mini-grids because the former are essentially smaller versions of the latter, often with lower capabilities and supply end-users by way of a low voltage distribution system only.

Often, mini-grids are powered by hybrid electricity generation systems. These systems use two or more electricity generating technologies (e.g. a diesel-powered generator and a solar photovoltaic generator, or a combination of wind and solar systems) to generate electricity.

Mini-grids can enhance access to electricity services, thereby enabling end-users to experience the convenience, versatility and opportunities that such services offer. In Namibia, tens of thousands of potential beneficiaries remain un-electrified, despite the considerable electrification efforts undertaken since the early 1990s. Mini-grids can be particularly relevant for the electrification of rural areas.

Some argue that the continued influx of people in search of opportunities in Namibia's urban areas is unsustainable, and that the country's towns and cities already bear testimony to the fact that this rapid urbanisation strains service providers and creates a multitude of societal burdens. This perspective emphasises the importance of continued electrification of rural areas, noting that electrification approaches other than the provision of grid services holds the key to many rural and national development initiatives.

While the provision of conventional grid supplies is well-regulated in Namibia, most requirements to upscale the roll-out and use of mini-grids are not yet established. This Policy therefore addresses the pertinent policy and regulatory framework to enable the upscaled roll-out of mini-grids and other off-grid electricity services throughout Namibia.

Section 2.5 introduces a multi-tier electricity service framework that classifies the different electricity services that are typically provided by mini-grids and other off-grid electricity supply technologies.

2.4.2 Off-grid Electrification Technology: Stand-alone Single End-user Supply Systems

Stand-alone single end-user electricity supply systems (e.g. home electricity supply systems and others) provide electrical energy to individual end-users (e.g. the residents of a household).

In most cases, such electricity supply systems are not connected to any electricity distribution network and operate as an autonomous power supply. A large variety of stand-alone power supply systems are available, and their output capacity and longevity vary considerably.

Section 2.5 introduces a multi-tier electricity service framework that classifies the electricity services that are typically provided by small-scale stand-alone power supply systems, which includes home electricity supply systems and others.

2.5 Modern Off-grid Electricity Services

A large variety of electricity supply systems exist. The following multi-tier electricity service framework (MTF) enables the classification of such systems, based on the electricity services that such systems provide. The MTF approach is based on the provision of specific electricity services rather than on the consumption of a given amount of electrical energy. It underlines the realisation that end-users want to meet certain energy-related needs by using a specific energy service rather than their concern about how such a service is delivered. To illustrate, when someone would like to use an electric light, it is largely immaterial whether that service is powered by the electricity grid or an off-grid technology, provided the quality of service is comparable.

The MTF is based on distinct electricity service tiers. Often, these service tiers range from Tier 1 to Tier 5. In this way, Tier 1 (i.e. the lowest service tier) corresponds to the most basic provision of electricity services. Successively higher service tiers allow for additional electricity services to be provided. The highest service level available (i.e. Tier 5) corresponds to a service level that draws power from a reliable electricity grid. In other words, the availability, capacity and energy provided for under a Tier 5 connection is the same as, or very similar to, being connected to the main electricity grid.

Table 1 is a summary of the electricity service tiers and the characteristics that describe the dimensions of having ‘access to electricity’.

Table 1: Main characteristics of the MTF electricity service tiers

1. Availability	Services are available for a given period each day
2. Reliability	Services have a capped maximum number of disruptions per month
3. Quality	Voltage fluctuations do not negatively affect the use of applications or appliances
4. Affordability	Use of electricity costs less than a given percentage of an end-user’s income
5. Legality	Services are warranted by an authorised supply agent or their representative
6. Convenience	Services improve end-user experiences and perception of associated value
7. Health	Services do not increase the risk of exposure to negative health effects
8. Safety	Services do not increase the overall safety risk of end-users

The following sub-sections describe the MTF for institutions and households. In both cases, services may be provided by a stand-alone single-user system, a mini-grid or a grid connection. In this way, the MTF definitions span all possible technical solutions for the provision of a specified service level. The MTF does not include a service framework for business end-users since the needs of business end-users are very diverse and cannot readily be described in a fit-for-all framework like those for institutions and households, which are more homogeneous end-user groups.

2.5.1 Multi-tier Electricity Service Framework for Institutions

In most cases, the electricity requirements of schools, clinics and government offices are different from those of households. Therefore, the electricity service tiers for public institutions are guided by their specific service requirements and cost considerations.

This section introduces a 3-tier framework for electricity services for schools, clinics and government offices. Tier 3, the lowest service tier, provides essential electricity services required for limited lighting, communication and information technology (IT) infrastructure operations, and essential refrigeration facilities in clinics. Tier 4 provides more comprehensive electricity coverage. Tier 5, the highest service tier, corresponds to a grid-equivalent connection that provides full electrical and thermal energy services.

The MTF for schools, clinics and government offices ranges from Tier 3 to Tier 5. Each tier includes the following:

1. **Tier 3 – essential electrical energy services:** This service tier provides electricity for select essential services. For example, a school that is provided with electrical lighting for the administrative offices only during office hours; and power for select communication and IT services (which includes an internet connection, one computer and one laser printer during office hours). The provision of thermal services is excluded in this tier as these are most likely provided through non-electrical means; however, they are provided for the refrigeration of essential medicines in clinics.
2. **Tier 4 – comprehensive electrical energy services:** This service tier provides complete coverage of all relevant electrical energy services, thereby rendering it fully functional in terms of lighting, communications and IT services. The provision of thermal services is excluded in this tier as these are most likely provided through non-electrical means; however, they are provided for the refrigeration of essential medicines in clinics.
3. **Tier 5 - comprehensive plus thermal energy services:** As in Tier 4, this service tier is fully functional in terms of lighting, communications and IT services, and also supplies all thermal energy services which are powered by electricity. The Tier 5 service level is equivalent to a contemporary and largely unconstrained grid electricity service.

Table 2: Multi-tier electricity services framework for institutions

	Tier 3: 12 hours/day	Tier 4: 16 hours/day	Tier 5: 24 hours/day
Electricity services	Essential electricity services, which includes limited lighting and essential equipment use, as required for administrative purposes.	Comprehensive electrical coverage, which includes all administrative and other rooms, as required.	Comprehensive electrical coverage plus thermal energy services to ensure that the entire facility is fully electrified.

2.5.2 Multi-tier Electricity Service Framework for Households

A range of MTF home electricity services, as shown in Table 3, is most effective in meeting individual household electricity service requirements, while providing significant scope to select services that meet individual household affordability criteria. To illustrate, a Tier 1 system delivers limited lighting, radio as well as phone charging services. A Tier 2 system offers the same as a Tier 1 system, plus the use of a television and a fan. A Tier 3 system provides the services of a Tier 2 system, plus the use of select low-power appliances. A Tier 4 system provides the services of a Tier 3 system, plus moderate use of select household appliances. The most demanding electricity service tier is Tier 5, which

provides the same as Tier 4, plus the full use of common household appliances to ensure that appliances can be used for productive purposes.

In 2017, the Ministry of Mines and Energy decided that Tier 3 was to be regarded as the minimum specification in that all programmes and projects initiated by the Government would – by default – provide Tier 3 or higher service levels. At the time, the MME also stipulated that Tiers 1 and 2 were to be retained and offered to end-users who want to minimise their energy-related expenditure. Consumers that use Tier 1 or 2 electricity supply systems have elementary access to electricity, but these should not be counted in official access level statistics (as households with less than a Tier 3 service are not regarded as having access to electricity).

Table 3 presents the MTF for households, comprising five distinct electricity service tiers for off-grid household electricity use. The service tiers range from Tier 1 to Tier 5. Tier 1, as the lowest service level, provides the most rudimentary electricity services, while successively higher service tiers cater for increased electricity use and therefore provide a wider range of electricity services. Tier 5 in Table 3 corresponds to electricity services that are comparable to those available when connected to a reliable electricity grid. In other words, the availability, capacity and supply of energy by a Tier 5 stand-alone single end-user electricity supply system is similar to a domestic end-user connection to a reliable electricity distribution grid.

Table 3: Multi-tier electricity services framework for households

	Tier 1: 4 hours/day	Tier 2: 4 hours/day	Tier 3: 12 hours/day	Tier 4: 24 hours/day	Tier 5: 24 hours/day
Electricity services	<ul style="list-style-type: none"> • Lighting • Radio • Phone charging 	Tier 1 services, plus <ul style="list-style-type: none"> ○ television ○ fan 	Tier 2 services, plus <ul style="list-style-type: none"> ○ use of select low-power appliances, as well as a small refrigerator 	Tier 3 services, plus <ul style="list-style-type: none"> ○ moderate use of household power appliances 	Tier 4 services, plus <ul style="list-style-type: none"> ○ full use of household appliances and power tools

3 Policy Issues and Policy Statements

This section presents the main policy and regulatory issues and associated policy statements per major topic area. The sequence in which topic areas are addressed does not reflect their relative importance.

3.1 Foundational Statements

The motivation for and the planning, funding and communication of national electrification efforts relies on the consistent use of precise foundational statements that express national intentions and ambitions. This Policy provides a consistent and adequate system of foundational statements to anchor, motivate and guide future electrification efforts throughout the country.

Extending the national distribution grid to provide electricity services to remote communities and areas is often not viable. Where conventional grid electrification is not an option, off-grid electricity systems offer a credible alternative for the delivery of modern energy services for socio-economic development and the stimulation of productive uses of energy.

Key Issue:

1. Suitable foundational statements relating to the provision of off-grid electrification services are necessary to convey the Government's intent regarding such electrification undertakings.

Policy Objective: To provide a set of foundational statements to motivate and guide national off-grid electrification activities and efforts.

Policy Statements P1 Foundational Statements

Government will:

- P1.a accelerate national electrification efforts by providing off-grid electricity services where suitable;
- P1.b embrace off-grid technologies as the key contributor to extend access to electricity services to all;
- P1.c create an enabling legal, regulatory and institutional environment to enhance access to electricity services through off-grid technologies;
- P1.d deliver off-grid electrification services to remote and rural areas to foster decentralised socio-economic development, and to stimulate the productive uses of electricity;
- P1.e promote private sector investments and investment opportunities in off-grid areas;
- P1.f promote lowest levelised cost of electricity off-grid solutions by balancing the principle of technology neutrality against other national policies and priorities; and
- P1.g align national development and economic programmes and initiatives with the requirements to achieve access to electricity services for all.

3.2 Enabling Conditions and Mechanisms

An efficient enabling environment for off-grid electrification accelerates the pace and reach of such electrification efforts. This Policy identifies the key enabling conditions and mechanisms to operationalise and enable the effective implementation of national off-grid electrification efforts.

The following key policy and regulatory issues are critical and must be addressed:

Key Issues:

1. The national distribution grid cannot cost-effectively be extended to serve all.
2. Recent technological advances in decentralised electricity generation and storage have been significant and offer services comparable to those supplied by the national electricity grid.
3. National electrification strategies, planning, funding and implementation must take cognisance of recent technological advances to broaden the introduction and application of contemporary off-grid technologies to enhance access to modern energy services in Namibia.
4. Regulations and laws exist that pose barriers or contain gaps that hinder an enabling regulatory framework for the development of off-grid electrification.
5. Comprehensive data regarding off-grid electricity access is not currently available, which limits reporting and planning activities.
6. End-users may have the expectation that all electrification efforts will be in the form of connections to the national electricity distribution grid, which is unrealistic.

Policy Objective: To create the enabling conditions and mechanisms to benefit from advances in decentralised electricity generation, distribution and storage technologies to enhance off-grid access to electricity.

Policy Statements P2 Enabling Conditions and Mechanisms

Government will:

- P2.a adopt the MTF service level Tier 3 as the minimum service level to be provided as part of all national electrification programmes and projects;
- P2.b recognise the MTF Tier 3 as the minimum service level to be classified as having access to electricity;
- P2.c develop and implement a framework for comprehensively collecting data regarding off-grid electricity access throughout Namibia, including the monitoring and verification thereof;
- P2.d embrace off-grid electricity supply systems, such as mini-grids and other stand-alone off-grid electricity supply systems, as a means of delivering electricity services to end-users;
- P2.e level the legal, regulatory, funding and institutional playing fields for on- and off-grid electricity supply systems and identify barriers and gaps for legal review and amendment;
- P2.f harmonise national electrification strategies, planning and implementation documents and regulations by ensuring that on- and off-grid electricity supplies are treated on an equal footing;
- P2.g prepare the requisite framework conditions to integrate the use of off-grid electricity supply systems into all relevant national electrification efforts;

- P2.h ensure that electrification planning, including but not limited to updates of Rural Electrification Distribution Master Plans, Off-Grid Energisation Master Plans, National Integrated Resource Plans and others, treats on- and off-grid electrification efforts on an equal footing;
- P2.i assist with obtaining the necessary resources to broaden existing and create new tertiary capacity development, training and qualification opportunities (including vocational training) needed to ensure that off-grid electrification efforts can be implemented and kept sustainable and operational in the future;
- P2.j ensure that licensed electricity distributors keep their actual and potential customer base informed and aware of on- and off-grid electrification options, where these are offered; and
- P2.k enact a system of recognised quality and technical standards for all technologies, which includes quality controls, equipment certification, and the development, promulgation and enforcement of relevant technical standards.

3.3 Off-grid Electrification Businesses and Business Models

Electrification for end-users (except in the case of large power users) is achieved by a) creating a connection to the national distribution grid, b) connecting the end-user to a mini-grid, or c) the end-user obtaining supply from a stand-alone power supply system.

Presently, Regional Electricity Distributors (REDs), some municipalities and local and regional authorities, NamPower, and others are licensed to supply electricity to end-users via the national distribution grid. In contrast, business models for national off-grid electrification have not found their way into the day-to-day operations of local electricity utilities. Mainstreaming off-grid electrification requires the development and implementation of suitable off-grid electrification business models.

This Policy lays down the conditions that guide national off-grid electrification, and articulates the main rules that underpin the business models on which such electrification efforts are undertaken.

Key Issues:

1. Contemporary Namibian electricity utilities are almost exclusively focused on grid-connected operations.
2. More than half of Namibia's population does not benefit from access to electricity.
3. Achieving markedly higher national electrification rates is unlikely to occur by focusing on the extension of grid-connections and funding by the Government and utilities only.
4. Off-grid framework conditions must attract investors, and stimulate the development of innovative business models that result in the supply of electricity services to end-users.
5. The design of off-grid electrification business models must be sufficiently flexible to stimulate interest and investment, and to cater for the different needs and circumstances of rural off-grid communities and customers.

Policy Objective: To ensure that suitable off-grid business models are developed and enacted to accelerate off-grid electrification efforts throughout Namibia.

Policy Statements P3 Off-grid Electrification Businesses and Business Models

Government will:

- P3.a recognise the right of every end-user to own and operate a stand-alone off-grid electricity supply system, provided it is exclusively applied for own use, subject to applicable legislation;
- P3.b request the Regulator to develop and implement the necessary legal and regulatory provisions for off-grid systems to provide electricity services to third party off-takers, using service levels, sales modalities, technical and environmental standards, and consumer protection as guiding principles;
- P3.c encourage the Regulator to give preference to light-handed regulatory approaches in the creation of off-grid businesses and business models to incentivise the development and implementation of off-grid electrification programmes and projects;
- P3.d support national off-grid electrification efforts by and/or under the auspices of licensed electricity utilities;
- P3.e create the legal, regulatory and institutional requirements to encourage investments in off-grid electrification efforts;
- P3.f promote the use of mini-grids where the extension of the national electricity grid is not viable or is expected to be accomplished only in the far future;
- P3.g promote the use of stand-alone electricity supply systems other than mini-grids where end-user densities or related considerations favour the use of individual end-user supply technologies; and
- P3.h facilitate the development of suitable business models to enhance off-grid electrification initiatives by making efficient use of institutions and regulatory models, in close collaboration with all relevant stakeholders.

3.4 Funding, Incentives and Investor-friendly Conditions

A well-developed financial market, supported by committed financial institutions; dedicated regular electrification funding; incentives in the form of subsidies, grants, tax exemptions and other forms of fiscal support; and the availability of loans, is a pre-requisite for electricity utilities to undertake new projects. Similarly, investors wishing to establish new electricity businesses consider the availability and cost of capital and subsidy mechanisms as critical business determinants.

At the same time, offering several fiscal support measures enhances an investment-friendly market, and may result in lowering end-user charges such as tariffs. Often, however, a lack of coordination between role-players and decision-makers, confusion regarding regulation, procedural and approval delays, lack of suitable sources of funding, few or no subsidies and/or grants, inflexible tariffs, and an absence of other incentives are well-known impediments to incentivise investments in the electricity sector.

Namibia's electrification endeavours, especially those in rural areas, have greatly benefitted from donor funding in the past. While such funding avenues still exist, their scale and scope have reduced

over time. Today, the electrification of urban areas is the prerogative of licensed electricity distributors, while rural grid electrification focuses mostly on schools, clinics and Government offices.

Key Issues:

1. Public funding for large-scale off-grid electrification is limited.
2. Private investments are increasingly important to supplement scarce public funding.
3. A multitude of development- and climate-related funding sources exist.
4. Attractive framework conditions must be tailored to attract new investment funding.

Policy Objective: To create conducive investment conditions to secure private investments and development- and climate-related funding for off-grid electrification efforts in addition to Government funding.

Policy Statements P4 Funding, Incentives and Investor-friendly Conditions

Government will:

- P4.a request the Regulator to develop and enact streamlined and simplified regulatory processes, and application and licensing rules and mechanisms to attract investments in off-grid electrification service undertakings;
- P4.b develop and provide a suite of incentives for which investors in off-grid electrification programmes and projects can apply; these incentives include initiatives in the form of public-private partnerships with targeted support and fiscal incentives;
- P4.c develop and implement the legal requirements for offering exclusive area supply contracts, off-grid concessions and similar arrangements on a competitive basis to enhance off-grid investment conditions without undermining the roles, responsibilities and viability of existing licensees;
- P4.d annually provide funding for off-grid electrification;
- P4.e seek to attract donor-, grant-, investment- and climate-related funding for direct investments as well as the co-funding of off-grid electrification initiatives in Namibia; and
- P4.f provide easy access to country information such as ESI data, the regulatory environment and its requirements, potential programmes and projects, electrification plans, funding mechanisms, and other relevant information as a one-stop service to prospective off-grid electrification developers and investors.

3.5 Institutional, Governance and Ownership Considerations

Namibia's electrification efforts have primarily focused on connecting end-users to the national electricity distribution grid. However, the Rural Electricity Distribution Master Plan (REDMP), last updated in 2010, illustrates that many settlements and villages will not be connected to the electricity grid in the coming five to ten years, even if the plan was to be implemented to the letter.

There are a multitude of reasons why access to modern energy in general, and specifically the availability of electricity services, remains limited. This section of the Policy focuses on the main institutional and governance bottlenecks that must be addressed in order to improve energy access rates throughout the country.

Various institutional models exist to effectively anchor the systematic implementation of electricity service provisions. In the past, Namibia opted for a low interventionist model where the Ministry of Mines and Energy, as the country's overall energy custodian, in collaboration with NamPower, the REDs and select local government authorities, delivered such services as and when funding was available.

In rural Namibia, implementation was guided by the Rural Electricity Distribution Master Plan and Off-Grid Energisation Master Plans, but these have generally not delivered the desired outcomes. It is therefore important that this Policy articulates the main institutional and governance aspects that underpin the provision of electrification services in the future.

Key Issues:

1. The REDs model, with its area-covering licences and strong regional presence, offers opportunities to support the implementation of off-grid electrification efforts throughout Namibia rather than creating a new national institution for such purposes.
2. The institutional and governance aspects that underpin national electrification efforts must be described for future national electrification strategies and plans, and be integrated into the regulatory provisions to be developed for such purposes.
3. Ownership modalities differ substantially amongst the various off-grid electrification technologies and must be considered and, where necessary, accommodated in the institutional and governance provisions.
4. It is essential that the requisite regulatory provisions are developed and enacted for national off-grid electrification programmes and projects, with a view to accelerating the provision of services rather than stifling efforts. This includes the review and, where required, amendment or augmentation of existing legislation to eliminate barriers and gaps within the current regulatory environment.
5. Namibia's energy- and electricity-related laws, which set out the responsibilities of role players and provide the basis for specific regulations, must be extended to become specific and binding for national off-grid electrification efforts.

Policy Objective: To optimise existing institutional, regulatory and governance provisions and environment to accelerate the delivery of off-grid electrification services throughout Namibia, informed by best practice ownership modalities.

Policy Statements P5 Institutional, Governance and Ownership Considerations

Government will:

- P5.a request the Regulator to develop appropriate and enabling regulatory provisions to enhance the institutional, regulatory, accountability and governance provisions to effectively provide off-grid electrification services throughout the country;
- P5.b coordinate with other agencies and regulators to harmonise and coordinate laws and regulations applicable to off-grid electrification programmes and projects;

- P5.c ensure that future electrification strategies, plans and implementation provisions focus on the specification of realistic and tangible institutional and governance arrangements for both public and private sector entities and persons;
- P5.d incentivise the entry of developers and new service providers and the establishment of viable and sustainable business models to invigorate the delivery of off-grid electrification services to end-users, taking the multitude of ownership arrangements that characterise such technologies into account; and
- P5.e maximally leverage existing roles, capacities and responsibilities, and thereby ensure that, amongst others, the overall cost and complexity of providing services remains as low as achievable.

3.6 Tariffs, Cost Recovery and Subsidies

Off-grid electricity supplies often have different costs and cost drivers compared with their grid-supplied counterparts. This implies that off-grid tariffs, by their very nature, have markedly different drivers compared with the tariffs and tariff approaches used for conventional grid electricity supplies.

Namibian electricity tariffs are calculated to reflect the inherent cost of supply, in other words, they are cost-reflective. If off-grid tariffs are to be cost-reflective as well, then grid- and off-grid tariffs will most likely be markedly different. However, from an equitability and fairness perspective it could be argued that grid- and off-grid tariffs should be similar, provided that the electricity services they provide are comparable to one another. This almost certainly implies that subsidies must be available to bring tariffs onto the same footing.

Tariffs for electricity services provided by mini-grids or stand-alone home electricity supply systems must take into consideration that such systems often have energy and/or capacity constraints. Off-grid tariffs and connection options must therefore also take the underlying system limitations into account, in addition to their inherent costs and cost drivers.

As off-grid services are often provided to low-income communities or households, their affordability is critical. Innovative approaches to packaging services and setting tariffs are therefore required to optimise cost recovery by maximally responding to the end-users' energy needs and their affordability.

Electricity tariffs should balance the commercial viability of the electricity supply with the consumers' ability and willingness to pay for services. This necessitates regulatory oversight, both in terms of devising a tariff determination methodology and defining how service providers may charge for services.

As off-grid systems often have distinctly different capital and operational cost requirements compared with grid-supplied electricity services, tariffs for off-grid systems must be focused on the services and service levels they provide. In case subsidies and/or cross-subsidisation of services are required, suitable subsidisation mechanisms must be devised in order to attract non-state funded electricity services to end-users.

Currently, rural grid electricity supplies benefit from both capital and operational subsidies. Off-grid electricity services will therefore need to be tied into such subsidy flows to enhance their viability.

Key Issues:

1. Access to subsidies and financial support for grid- and off-grid rural electrification efforts remain disproportionately in favour of grid electrification.
2. Off-grid electricity provision must be tied into existing/new subsidy and funding mechanisms.
3. Electricity service tariffs do not have a 'one-for-all' determination approach and must take delivery modalities, end-user needs and affordability constraints, and other location-specific viability criteria into account.
4. The complexity of off-grid electricity service tariffs must be limited as far as possible to allow unschooled and/or non-specialist end-users to understand the costs and benefits provided by such services.
5. For many off-grid structures and arrangements it will not be possible to recover all capital costs from the end-user base, which implies that such services will only be available if they are subsidised.
6. Depending on the system design, number of end-users serviced, and other factors, operational cost recovery may not be achievable, therefore necessitating on-going subsidy payments.
7. The continued long-term availability of subsidies remains a risk that off-grid business models must address.
8. A tariff methodology is in place for the regulation of tariffs related to grid-delivered electricity services. However, for off-grid services it is often not useful to formulate tariffs based on energy consumption; instead, they must be based on service delivery levels. A Namibian methodology for the latter does not exist.
9. End-user expectations regarding off-grid versus grid tariffs must be managed.

Policy Objective: To ensure that a suite of off-grid electricity service tariffs and subsidy mechanisms are devised that balance end-user needs with those of viable providers and committed investors.

Policy Statements P6 Tariffs, Cost Recovery and Subsidies

Government will:

- P6.a request the Regulator to ensure that subsidies and cross-subsidies between grid and off-grid electricity services are balanced;
- P6.b support the Regulator to ensure that off-grid service provision and tariffs take actual end-user needs and constraints into account;
- P6.c request the Regulator to develop a realistic and flexible off-grid tariff methodology that balances end-user requirements with those of service providers and investors;
- P6.d encourage innovative operational and service provision models that minimise costs and maximally meet end-user needs; and
- P6.e encourage potential investors to propose business modalities that result in the accelerated delivery of off-grid electricity services at affordable tariffs.

3.7 Grid Encroachment and the Compatibility of Grid and Off-grid Systems

Off-grid investors have a variety of expectations regarding their investments, which include return considerations, investment periods, and the ability to recoup investments. A key concern for off-grid investors is the possibility that the grid prematurely arrives in operational areas.

When the grid arrives in areas that have been benefitting from off-grid electrification programmes and projects, the following questions are important: a) are off-grid networks compatible with the requirements of the grid, b) will mini-grid systems become redundant when their networks are connected to the grid, and c) will stand-alone systems be replaced with grid connections?

If the grid arrives, it is likely that all compatible mini-grid networks will be connected to the grid. To enable such connection, mini-grid networks must be designed, built and maintained according to standards that are compatible with those used for the national grid.

Off-grid business models that use mini-grids and stand-alone systems will almost certainly be undermined by the arrival of the grid. This means that off-grid investors may need the assurance that grid encroachment will not take place during the investment period, and/or that they will be compensated in case the operational viability of their systems is negatively affected when the grid arrives.

Key Issues:

1. Grid encroachment in areas where off-grid investors are active must be managed and necessitates transparent rules, procedures and standards.
2. Mini-grids should be designed and built according to grid-compatible standards to minimise stranded investments if and when the grid arrives.
3. The operation and management of mini-grids must be compatible with contemporary grid requirements, which should include their reliability and safety.
4. Off-grid business models must take the premature arrival of the grid into account.
5. Grid expansion plans need to avoid premature or unplanned grid arrivals in areas that benefit from off-grid services.

Policy Objective: To provide assurance to off-grid investors regarding the encroachment of the grid, and to ensure the compatibility of grid and off-grid systems.

Policy Statements P7 Grid Encroachment and the Compatibility of Grid and Off-grid Systems

Government will:

- P7.a request the Regulator to ensure that mini-grid network design, operational, maintenance and safety standards are compatible with standards and codes applicable for grid infrastructure;
- P7.b ensure that nationally approved off-grid service business models include provisions for the loss of income or unmet returns on investment brought about by unforeseen grid encroachment;
- P7.c request the Regulator to review the tariffs and related charges for off-grid services where the arrival of grid services is delayed beyond the expected date; and
- P7.d ensure that long-term grid expansion plans are developed, systematically implemented and made available publicly.

4 Implementation Framework

This section describes the high-level framework within which the Off-Grid Electrification Policy will be implemented.

4.1 Institutional Arrangements

Contemporary off-grid electrification efforts necessitate the effective collaboration of a multitude of stakeholders. This is best facilitated by identifying the key institutional actors and their responsibilities under this Policy, as summarised in Table 4.

Table 4: Key institutional actors and their responsibilities under this Policy

Institution	Roles
Ministry of Mines and Energy (MME)	The MME has the primary responsibility to implement the Off-Grid Electrification Policy, and it is the institutional anchor that coordinates all matters that relate to national off-grid electrification. Where appropriate, the MME may delegate activities to entities active in the electricity sector.
Ministry of Finance (MoF)	The MoF is to annually provide budget allocations to the MME to fund national off-grid electrification programmes and projects.
Ministry of Environment and Tourism (MET)	The MET is to ensure that environmental legislation and regulations are created that facilitate the uptake and use of off-grid electrification technologies in Namibia, as well as their eventual disposal.
National Planning Commission (NPC)	The NPC is, on the whole, responsible for managing and monitoring the implementation of Government policy, and therefore supervises the MME's implementation of this Policy. Regarding this Policy, the NPC is to ensure the integration and alignment of all matters that relate to electricity access planning with other national planning and development activities.
Regulator (currently the ECB)	The Regulator is responsible for the implementation of all activities that fall within its regulatory mandate, in compliance with the provisions of this Policy. As such, the Regulator is to develop and update the regulatory provisions governing off-grid electrification, as envisaged in this Policy.
Electricity distributors	Electricity distributors are responsible for the development, maintenance and continued operation of the grid. Regarding this Policy, electricity distributors must support the Government's off-grid electrification efforts and initiatives and implement or support their implementation in their areas of responsibility.
Namibian Standards Institution (NSI)	The NSI is to adopt and publish relevant standards and technical regulations that relate to off-grid electricity supply systems.

Institution	Roles
Namibia Energy Institute (NEI)	The NEI is responsible for the implementation of activities that are part of its designated mandate, as well as for those that may be added in the implementation of this Policy.
Private sector entities, as well as off-grid investors and service providers	Private sector entities include vendors of off-grid technologies as well as off-grid investors and service providers that supply, maintain, own, operate, and/or fund off-grid technologies and systems, as envisioned in this Policy.
Tertiary education and training institutions, as well as the NTA and NQA	Tertiary education and training institutions and NTA need to ensure that their technical, vocational and/or engineering curricula meet the needs of off-grid technologies in Namibia, which may include R&D projects. The NQA is to engage in the development and approval of off-grid-related qualifications.
End-users of off-grid electricity services	Consumer involvement is critically important for the successful implementation of off-grid electrification initiatives and must include expectation management.

4.2 Legal and Regulatory Provisions

The Electricity Act, 2007 (Act No. 4 of 2007) is the legal framework that underpins the licensing, management and operation of electricity generation, transmission, distribution and supply in Namibia. Where required, regulations, rules, codes, standards and related procedures have been developed to direct and guide licensees active in the electricity industry.

Regarding off-grid electrification, additional legal and regulatory requirements must be developed, which are identified in this Policy. The main areas that require further development are identified in individual policy statements as well as the Implementation Action Plan, and they specifically include the following:

- i. Aligning national development and economic programmes and initiatives to achieve access to electricity services for all.
- ii. Levelling the legal, regulatory, funding and institutional playing fields between on- and off-grid electricity supplies.
- iii. Harmonising the development of national electrification strategies, planning, implementation and regulation by treating on- and off-grid electricity supplies on an equal footing.
- iv. Making resources available for tertiary capacity development and training to ensure that off-grid electrification efforts are implemented and kept operational.
- v. Enacting a system of quality and technical standards for off-grid technologies that benefit from national and/or utility electrification funding and support initiatives.
- vi. Developing and providing incentives for off-grid electrification investors, which includes the development of public-private partnerships.

- vii. Coordinating Government agencies, institutions and regulators to harmonise laws and regulations applicable to off-grid electrification programmes and projects.
- viii. Developing and implementing the legal requirements to offer exclusive area supply contracts, off-grid concessions and similar arrangements to enhance off-grid investment conditions.
- ix. Encouraging innovative operational and service provision models that result in the accelerated delivery of off-grid electricity services at affordable tariffs.

4.3 Resource Mobilisation

The mobilisation of resources required to implement this Policy is most likely to proceed using a variety of channels and approaches, of which the main options and responsibilities are summarised in Table 5.

Table 5: Options and responsibilities relating to resource mobilisation to implement this Policy

Funding Source	Envisaged Application	Main Responsibility
Government budget	Activities that cannot be funded from the sources below	MME, in consultation with the NPC and MoF
National Energy Fund (NEF)	Activities that fall within the legal scope and financial means of the NEF	MME
ECB Levy	Activities that fall within the Regulator's formal responsibilities	Regulator, with authorisation of the MME, as appropriate
Public-Private Partnerships (PPPs)	Activities from which the PPPs can benefit	MME / MoF/ MURD, to facilitate the processes required to enable such funding
Private sector	Activities from which the private sector can directly benefit	MME, to facilitate the processes required to enable such funding
Grant and Loan funding, which includes climate-related funding	Activities that can benefit from such funding	MME, in consultation with OMAs that are tasked with facilitating and administering such funding
Financial Instruments/Markets	Activities from which the private sector can directly benefit	MoPE/ MoF, to facilitate the processes required to enable such funding

4.4 Reporting, Monitoring and Evaluation

The implementation of this Policy will be monitored and evaluated by the NPC, focusing specifically on projects that originate from this Policy, in accordance with the NPC's mandate.

Once the Policy has been approved, regular reporting by the MME to the NPC needs to be agreed to by both parties. Monitoring and evaluation should be broadly based on the Implementation Action Plan, which is an integral part of this Policy, and which may, from time to time, be expanded as part of the MME's evolving strategic and action plans.

4.5 Advocacy and Dissemination

The MME is responsible for the dissemination of this Policy, and the facilitation of all advocacy activities associated with it.

4.6 Implementation Action Plan

This section presents the Implementation Action Plan and identifies the key implementation activities for each policy area contained in this Policy.

This Implementation Action Plan is structured as follows:

- The Plan includes the same topic areas as contained in this Policy.
- Policy statements are identified using the (P.x) reference.
- Action items are identified using (A.x) references, to readily enable the cross-referencing of policy statements and associated action items.¹
- Occasionally, action items under one policy topic may also address requirements of other policy topics.

The Implementation Action Plan identifies target outcomes across three principal time periods: a short-term implementation period up to 2022, a medium implementation period up to 2027, and a long-term implementation period up to 2032.

As is usual for action plans, most actions are focused on the short term and only a few actions are planned to commence several years into the future. It is therefore recommended that the Implementation Action Plan be reviewed at intervals not exceeding three years (i.e. in 2022, 2025 and 2028), taking the progress made and changing national priorities and needs into account.

The Implementation Action Plan identifies the entity/entities responsible for initiating specific actions, as well as the entity responsible for mobilising the requisite funding. This does not imply that the identified entity must also fully execute the activity (i.e. the responsible entity may delegate when appropriate, but retains the responsibility for initiating the activity and for achieving the outcomes). Similarly, the entity responsible for mobilisation of funding does not necessarily have to fund the activity itself, but must mobilise funding from whatever source may be available and suitable.

Entities are referred to in the following tables by their abbreviations, which are listed in the section on Acronyms and Abbreviations.

¹ Note that action item sub-numbers (e.g. A20.1) do not imply the existence of a link to the policy statement numbered P20.1, as this numbering merely implies that 'A20' action items refer to the 'P20' Policy statements.

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Ref No.	Action Description	Short-Term Target 2019-2022	Medium-Term Target 2019-2025	Long-Term Target 2019-2032	Responsible for Action / Funding
P1: Foundational Statements					
A1.1	Align national development and economic programmes and initiatives with the requirements to achieve access to electricity services for all.	National development and economic plans aligned by 2021.	National development and economic plans are devised to further enhance access to electricity services for all.		NPC / NPC
P2: Enabling Conditions and Mechanisms					
A2.1	Level the legal, regulatory, funding and institutional playing fields for on- and off-grid electricity supply systems.	Legal and regulatory barriers and gaps identified by 2020. Legal and regulatory review and amendments undertaken by 2021.	New policy and regulatory provisions are developed which ensure that on- and off-grid electricity supplies operate on a level playing field.		MME & Regulator / MME & Regulator
A2.2	Harmonise national electrification strategies, planning, implementation and regulations to ensure that on- and off-grid electricity supplies are treated on an equal footing.	National electrification strategies and plans harmonised by 2021.	New national electrification strategies and plans treat on- and off-grid electricity supplies on an equal footing.		MME / MME
A2.3	Integrate the use of off-grid electricity supplies into all relevant national electrification efforts.	Framework conditions developed by 2021.	Future frameworks integrate off-grid electricity supplies into all relevant national electrification efforts.		MME / MME
A2.4	Broaden existing and/or create new tertiary capacity development, training and qualification opportunities (including vocational training) to ensure that off-grid electrification efforts are implemented and kept sustainable and operational.	Capacity development and training barriers and gaps identified by 2020. Amended curricula implemented by 2022.	Future capacity development and training curricula include contemporary off-grid electrification topics.		MoHE / MoHE
A2.5	Licensed electricity distributors keep their actual and potential customer base informed and aware of on- and off-grid electrification options, where these are offered.	Information and awareness gaps identified by 2020. End-user	Future information and communication materials include factual information covering grid and off-grid electrification options, where these are provided.		Electricity distributors / Electricity distributors

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Ref No.	Action Description	Short-Term Target 2019-2022	Medium-Term Target 2019-2025	Long-Term Target 2019-2032	Responsible for Action / Funding
		communications include relevant topics by 2021.			
A2.6	Enact a system of quality and technical standards for all technologies that benefit from national and/or utility electrification funding and support initiatives, which include quality controls, equipment certification, and the development, promulgation and enforcement of relevant technical standards.	Barriers and gaps in quality and technical standards identified by 2021. Amended system of quality and technical standards enacted by 2022.	New quality and technical standards for electrification are regularly updated to remain current.		NSI & Regulator / NSI
P3: Off-grid Electrification Businesses and Business Models					
A3.1	Develop and implement the legal and regulatory provisions for off-grid systems to provide electricity services to third party off-takers, using service levels, sales modalities, technical and environmental standards, and consumer protection as guiding principles.	Legal and regulatory provisions for off-grid supplies identified by 2020. Relevant provisions addressed by 2021.	New legal and regulatory provisions ensure that the modalities whereby off-grid systems provide services are and remain adequately addressed.		MME & Regulator / MME & Regulator
A3.2	Create the legal, regulatory and institutional requirements to encourage investments in off-grid electrification efforts.	Relevant legal and regulatory provisions identified by 2020. Provisions included by 2021.	New legal, regulatory and institutional provisions ensure that investments in off-grid electrification efforts are explicitly encouraged.		MME & Regulator / MME & Regulator
A3.3	Initiate and guide the development of suitable business models to enhance off-grid electrification initiatives.	Development of suitable business models to enhance off-grid electrification initiated by 2021.	New off-grid business models are assessed as and when these are proposed by third-party providers.		MME / MME
P4: Funding, Incentives and Investor-friendly Conditions					
A4.1	Develop and enact streamlined and simplified regulatory processes, application and licensing rules and mechanisms to attract investments in off-grid electrification undertakings.	Relevant regulatory provisions updated by 2022.	Future regulatory provisions governing off-grid electrification attract investments.		Regulator / Regulator

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Ref No.	Action Description	Short-Term Target 2019-2022	Medium-Term Target 2019-2025	Long-Term Target 2019-2032	Responsible for Action / Funding
A4.2	Develop and introduce a suite of incentives for which investors in off-grid electrification programmes and projects can apply, which also include initiatives in the form of public-private partnerships with targeted support and fiscal incentives.	Suite of incentives prepared by 2022.	Relevant measures are regularly assessed and updated to incentivise investments in off-grid electrification.		MME & MoF / MME
A4.3	Develop and implement the legal requirements to offer exclusive area supply contracts, off-grid concessions and similar arrangements to enhance off-grid investment conditions.	Legal requirements identified by 2021. Amendments to legal requirements enacted by 2022.	Future legal requirements regularly updated to enhance off-grid service provision by investors.		MME / MME
A4.4	Annually provide funding for off-grid electrification.	Annual on- and off-grid budget allocated.			MME / MoF & NEF
A4.5	Attract donor-, grant-, investment- and climate-related funding for direct investments as well as the co-funding of off-grid electrification initiatives in Namibia.	Programme to acquire donor funding developed by 2020 and implemented by 2021.	New and emerging funding opportunities are regularly and systematically targeted.		MME / MME
P5: Institutional, Governance and Ownership Considerations					
A5.1	Develop appropriate and enabling regulatory provisions to enhance the institutional, regulatory and governance provisions to effectively provide off-grid electrification services throughout the country.	Regulatory gaps identified by 2020. Regulatory amendments finalised by 2022.	Future regulatory provisions take the requirements of continued off-grid electrification efforts into account.		Regulator / Regulator
A5.2	Harmonise and coordinate laws and regulations applicable to off-grid electrification programmes and projects.	Initiatives relevant to off-grid electrification identified by 2020 and enacted by 2022.	Programmes and projects are regularly assessed to ensure that barriers and gaps that hinder off-grid electrification are addressed.		MME / MME
P6: Tariffs, Cost Recovery and Subsidies					

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Ref No.	Action Description	Short-Term Target 2019-2022	Medium-Term Target 2019-2025	Long-Term Target 2019-2032	Responsible for Action / Funding
A6.1	Balance subsidies and cross-subsidies between grid and off-grid electricity services.	Off-grid tariff methodology developed by 2021. Subsidy mechanism formulated by 2022.	Grid and off-grid tariffs are devised to balance the requirements of subsidies and cross-subsidies.		Regulator / Regulator
A6.2	Develop off-grid services and tariffs that are based on community engagement and an adequate understanding of actual end-user needs and constraints.	Consumer information needs and requirements identified in 2020. Annual awareness campaigns commence in 2021.	Annual awareness campaigns ensure that consumers remain informed.		Regulator / Regulator
P7: Grid Encroachment and the Compatibility of Grid and Off-grid Systems					
A7.1	Ensure that mini-grid network designs and operational, maintenance and safety standards are compatible with those applicable for grid infrastructure.	Network requirements identified in 2020. Programme of action formulated in 2021; implemented from 2022.	New network design requirements are regularly updated to ensure harmonisation between grid and off-grid requirements.		MME & Regulator / MME
A7.2	Long-term grid expansion plans are developed, adhered to and made available to off-grid service planners and investors.	Long-term grid expansion plan formulated in 2021; implemented from 2022.	Grid expansion plans are kept current and made publicly available.		MME / MME

Annexure A: Multi-tier Framework for Mini-grids and Stand-alone Single End-user Supply Systems

Table 6: Multi-tier electricity services framework for institutions

	Tier 3: 12 hours/day	Tier 4: 16 hours/day	Tier 5: 24 hours/day
Electricity service(s)	Essential electricity services, which includes limited lighting and essential equipment use, as required for administrative purposes.	Comprehensive electrical coverage, which includes all administrative and other rooms, as required.	Comprehensive electrical coverage plus thermal energy services to ensure that the entire facility is fully electrified.
1. <i>Availability</i>	12h/d ² at 200W ³ or more	16h/d at 1 000W or more, scaled to size of institution	24h/d at 2 000W or more, scaled to size of institution
2. <i>Reliability</i>	Minimum 50% ⁴ of service available under any normal ⁵ environmental conditions	Complies with grid quality of service standard and technical rules, scaled to 16h ⁶ supply per day with energy/capacity constraints	Complies with grid quality of service standard and technical rules
3. <i>Quality</i>	Electrical equipment can be used without risk of damage due to quality deviations	Complies with grid quality of supply standard and technical rules	Complies with grid quality of supply standard and technical rules
4. <i>Affordability</i>	Less than twice the cost of obtaining the same capacity and energy from the grid	Regulated tariffs for consumption and capacity	Standard regulated grid electricity tariffs
5. <i>Legality</i>	3-year service warranty	Subject to regulated licensee supply conditions	Subject to regulated grid licensee supply conditions
6. <i>Convenience (expressed as a service level)</i>	Lighting of 2 000lh/d ⁷ and an average draw of 200W over 12h/d	Unconstrained efficient lighting and an average draw of 1 000W over 16h/d	Unconstrained efficient lighting and an average draw of 2 000W over 8h/d
7. <i>Health</i>	No additional indoor particulate emissions because of such services	No additional indoor particulate emissions because of such services	No additional indoor particulate emissions because of such services
8. <i>Safety</i>	Overload, earth leakage (where applicable) & short-circuit protection	Overload, earth leakage and short-circuit protection	Overload, earth leakage and short-circuit protection
A. <i>Services to Schools</i>	Lighting, internet connection and Wi-Fi hotspot, one computer and one laser printer in admin. office in 8h/d	Tier 3 plus room lighting in all classrooms for 8 h/d, plus one low amperage socket per classroom, plus small refrigerator in office	Full lighting and appliance use as well as water heating and space cooling/heating
B. <i>Services to Clinics</i>	Lighting, internet connection and Wi-Fi hotspot, one computer and one laser printer in admin. office during 8h/d, plus small refrigerator for 24h/d for essential medicines	Tier 3 plus use of low power appliances and medical equipment for 16h/day and a full refrigerator for 24h/d	Full lighting and appliance use as well as water heating and space cooling/heating
C. <i>Services to Offices</i>	Lighting, internet connection and Wi-Fi hotspot, one computer and one laser printer in one office during 8 office hours	Tier 3 plus lighting in all office rooms, one computer per room, and other basic non-thermal office appliances	Full lighting and appliance use as well as water heating and space cooling/heating
D. <i>Additional Services</i>	None	Staff houses have at least Tier 3 household access	Staff houses have Tier 5 household access, and water supply is electrified, where applicable

² h/d = hours per day

³ W = Watt

⁴ For 50% of the daily electrical energy requirement, at full power rating (i.e. if the norm is 4h/day at 5W then 50% means 2h/day at 5W).

⁵ "Normal environmental conditions" include events such as intermittent cloud cover which affect the performance of solar PV systems.

⁶ h = hours

⁷ lh/d = lumen hours per day

Table 7: Multi-tier framework for households

	Tier 1: 4 hours/day	Tier 2: 4 hours/day	Tier 3: 12 hours/day	Tier 4: 24 hours/day	Tier 5: 24 hours/day
Electricity services	Lighting, radio and phone charging	Tier 1 plus a television and a fan	Tier 2 plus use of select low-power electrical appliances	Tier 3 plus moderate use of select electrical household appliances	Tier 4 plus full use of common electrical household appliances
1. <i>Availability</i>	4h/d at 5W or more in the evening (~20Wh/d) ⁸	4h/d at 50W or more in the evening (~200Wh/d)	12h/d at 180W or more with at least 4 hours during the evening, plus sufficient capacity to operate a small refrigerator (~2.2kWh/d) ⁹	24h/d at 600W or more (~9.6kWh/d)	24h/d at 2 000W or more
2. <i>Reliability</i>	Minimum 50% of service available under any normal environmental conditions	Minimum 50% of service available under any normal environmental conditions	Minimum 50% of service available under any normal environmental conditions	Complies with grid quality of service standard and technical rules, scaled to 16h supply per day with energy and capacity constraints	Complies with grid quality of service standard and technical rules
3. <i>Quality</i>	Electrical equipment can be used without risk of damage due to supply quality deviations	Electrical equipment can be used without risk of damage due to supply quality deviations	Electrical equipment can be used without risk of damage due to supply quality deviations	Complies with grid quality of supply standard and technical rules	Complies with grid quality of supply standard and technical rules
4. <i>Affordability</i>	Less than 5% of household income	Less than 5% of household income	Less than 5% of household income	Less than 5% of household income	Less than 5% of household income
5. <i>Legality</i>	2-year service warranty	3-year service warranty	4-year service warranty	Subject to regulated licensee supply conditions	Subject to regulated grid licensee supply conditions
6. <i>Convenience (expressed as a specific service level)</i>	Lighting of more than 500lh/d	Lighting of 1 000lh/d and 4h/d for a television and fan	Lighting of 1 500lh/d and 8h/d for a television and fan, 12h/d for other limited low power electricity use, which includes a small refrigerator	Unconstrained efficient lighting, television, fan, and moderate appliance use	Unconstrained efficient lighting, 5h/d for a television and fan, and 12h/d for electrical appliance use as well as thermal use

⁸ Wh/d = watt hour per day

⁹ kWh/d = kilo-Watt hours per day

	Tier 1: 4 hours/day	Tier 2: 4 hours/day	Tier 3: 12 hours/day	Tier 4: 24 hours/day	Tier 5: 24 hours/day
7. Health	No additional indoor particulate emissions because of such services	No additional indoor particulate emissions because of such services	No additional indoor particulate emissions because of such services	No additional indoor particulate emissions because of such services	No additional indoor particulate emissions because of such services
8. Safety	Overload, earth leakage (where applicable) and short-circuit protection	Overload, earth leakage (where applicable) and short-circuit protection	Overload, earth leakage (where applicable) and short-circuit protection	Overload, earth leakage and short-circuit protection	Overload, earth leakage and short-circuit protection
A. Anticipated practical service provided	One to two hours task lighting from a single light source, allowing reading in reasonable light levels ¹⁰ , plus one smartphone charged per day	Two to four hours task lighting from a single light source, allowing reading in reasonable light levels, plus one smartphone charged per day, one small television for 4 hours per day plus one small fan for 4 hours per day	Up to five hours room lighting for 1-2 rooms, plus 2 smartphones charged per day, 1 medium television for 4 hours per day, one medium fan for 4 hours per day, small appliances for 2 hours per day, and the ability to operate a small energy efficient refrigerator	Grid equivalent but energy and capacity constrained, moderate appliances only, no thermal use	Grid or grid equivalent supply, not energy constrained (capacity constrained only)
B. Likely delivery method	Stand-alone Pre-packaged Solar lantern with phone charging, DC only	Stand-alone Pre-packaged Large solar lantern, pico-solar kit or small SHS, DC only	Stand-alone installation (large SHS) or limited micro- or mini-grid, DC and/or AC	Limited mini-grid, AC	Grid or near-grid-equivalent mini-grid, AC
C. Government target	Voluntary option only	Voluntary option only	Default off-grid supply option, representing the minimum option adopted by the Government	Default mini-grid supply option	Default on-grid supply option

¹⁰ "Reasonable light levels" means a lighting intensity that allows for reading without incurring damage to eyesight.