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FULL REPORT

Off-Grid Funding Strategy

Ethiopia

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About This Document

SouthSouthNorth Projects Africa (SSN) was contracted by the NDC Partnership to develop a funding strategy for the Ethiopian off-grid energy sector as part of the Climate Action Enhancement Package. Co-funding for this work was provided by the Mobilising Investment Project which is described above.

SSN has been engaged in the off-grid sector in Ethiopia since 2010 through The Climate and Development Knowledge Network (CDKN) and, more recently with Mobilising Investment. Mobilising Investment's primary objective is to build funding support for the implementation of Nationally Determined Contributions (NDC) in seven developing countries in order to drive climate action with increased urgency and ambition. In Ethiopia renewable energy mini-grids for rural electrification emerged from scoping studies as a pivotal driver of the country's developmental agenda and key to the country achieving its NDC targets.

A key output from Mobilising Investment was a pre-feasibility study to evaluate the financial viability of eleven mini-grid sites at agriculture clusters distributed throughout the country. The study revealed significant potential given a set of assumptions around financing (Veritas Consulting 2020) and was picked up by various international donors who have committed to providing derisking funding to implement the pilot programme. This is an important step towards planning for the larger programme.

Research for this report included several visits to Ethiopia during 2018 and 2019 to meet with key Government employees, attend stakeholders events and visit Agriculture Commercialisation Clusters. During 2020, telephonic interviews and consultations were held with a broad group of stakeholders from government, the private sector and donor agencies.

Funding NDCs in sub-Saharan Africa is challenging, but has never been more urgent. The aim of this report is to provide additional perspective, fresh insights and offer approaches and information that policy makers and the private sector will find useful. The report is structured with a summary and set of recommendations at the beginning of each section to make it easier to read. Each section is complemented with further information in the Annexes.

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1. Executive Summary

1.1. Background

Climate change remains a global existential threat and the current decade is viewed by the scientific community as the last chance to avoid catastrophic climate breakdown. Yet global greenhouse gas (GHG) emissions continue to rise. Meeting Paris Agreement targets to limit global temperature rise to 1.5°Celsius, while achieving sustainable development, will require hundreds of billions in new investments, and a deliberate shift toward low-carbon, climate-resilient economic models. While the supply of catalytic climate finance has reached record levels, more is required to fund the transition and it needs to be used in a more transformative manner, particularly in Sub-Saharan Africa where rapid population growth will increase energy and resource demands exponentially.

2020 marks five years since the Paris Agreement and is an opportunity for parties to the agreement to submit updated NDCs with enhanced ambition. The first round of mitigation pledges in 2015 are insufficient to limit warming to under 1.5°C and increased ambition in the updated NDCs are critically important to achieve the climate targets outlined in the Agreement. In response, some of the world's most carbon intensive economies have updated their commitments: the European union has committed to more ambitious targets to cut emissions by 55% compared to 1990 levels by 2030; China has expressed commitment towards carbon neutrality by 2060 and expects to be able to reach the peak in emissions earlier than communicated previously; and under the Biden administration the USA has rejoined the Paris Agreement and placed climate change as a central pillar of its policy agenda. If the global community is to limit climate change, the next decade will see a fundamental transformation to economic systems that are required to build a low carbon future.

Energy access powered by affordable renewable energy, has an important role to play in the developing world by reducing pressure on ecosystems and powering rural livelihoods. Mini-grids in Africa act as rural development engines that enable livelihoods and support agriculture productivity through irrigation and other productive uses. Over the past decade, technology and business model innovation, coupled with significant private and public investments, have delivered clean energy to hundreds of millions of beneficiaries. The International Energy Agency (IEA) projects that mini-grids are a \$190 billion investment opportunity between now and 2030, also noting that mini-grids and other distributed renewable solutions are the least cost option for three-quarters of all new connections needed in sub-Saharan Africa, where more than 600 million people still lack basic supply.

Ethiopia's drive for universal access is complicated by the COVID-19 pandemic which has resulted in an unprecedented global humanitarian and economic crisis with resulting pressure on the urgent drive for climate action. The impacts have been particularly severe for developing economies, causing knock-on effects on sovereign debt positions. The pandemic has highlighted the interlinkages between traditional cooking, gender, health, and the environment. Improved and clean cookstoves are an important intervention that have seen traction in many parts of Africa however more comprehensive solutions are required that can reduce the increasing pressure of harvesting fuelwood from ecosystems as the population increases in size. Further linkages between energy access and universal healthcare are underlined by the need for cold storage for COVID-19 vaccines to support the universal vaccine drive.

There are no easy solutions to the challenge of funding climate action in sub-Saharan Africa. This is mirrored in Africa's infrastructure gap which has widened over time. Infrastructure development plays a major role in promoting growth and reducing poverty and closing the gap would be a win-win for all stakeholders. In Africa, underdeveloped infrastructure continues to be a binding constraint to sustainable development and finding a solution that matches developed country's savings with Africa's infrastructure requirements would lead to lasting benefits, including progress towards achieving the Sustainable Development Goals (SDGs) and lifting millions of Africans out of poverty.

1.2. Our Approach

The barriers to funding energy access in Africa are systemic in nature and require an integrated response. This report highlights key elements of the Ethiopian off-grid programme and addresses the challenge by proposing three specific interventions:

1. Using a framework developed by the World Bank, the report examines policy levers, market development opportunities, carbon markets and other enabling environment factors that can address investment barriers and unlock funding from various sources.
2. An argument is presented for the adoption of a Water-Energy-Food Nexus approach. This approach will support integrated rural economy policy formation and importantly reduce the risk of policies that may result in maladaptation to climate change. Protecting and supporting agricultural productivity will assist beneficiaries of the off-grid electrification programme to afford tariffs, which is a key requirement of a financially sustainable programme. Changes to agriculture methods will have both adaptation and mitigation benefit.
3. The report makes the case for an off-grid endowment fund. Endowments are emerging financial instruments in the climate space. The proposed endowment fund will provide asset managers with an inflation hedge, while investment proceeds can act as a first-loss reserve to attract funds from African Financial Institutions and also deliver environmental and social impact by providing affordable debt as part of a blended finance platform. The fund will take at least 24-30 months to establish and will require development funding to design and implement.

Ethiopia Off-Grid Funding Strategy

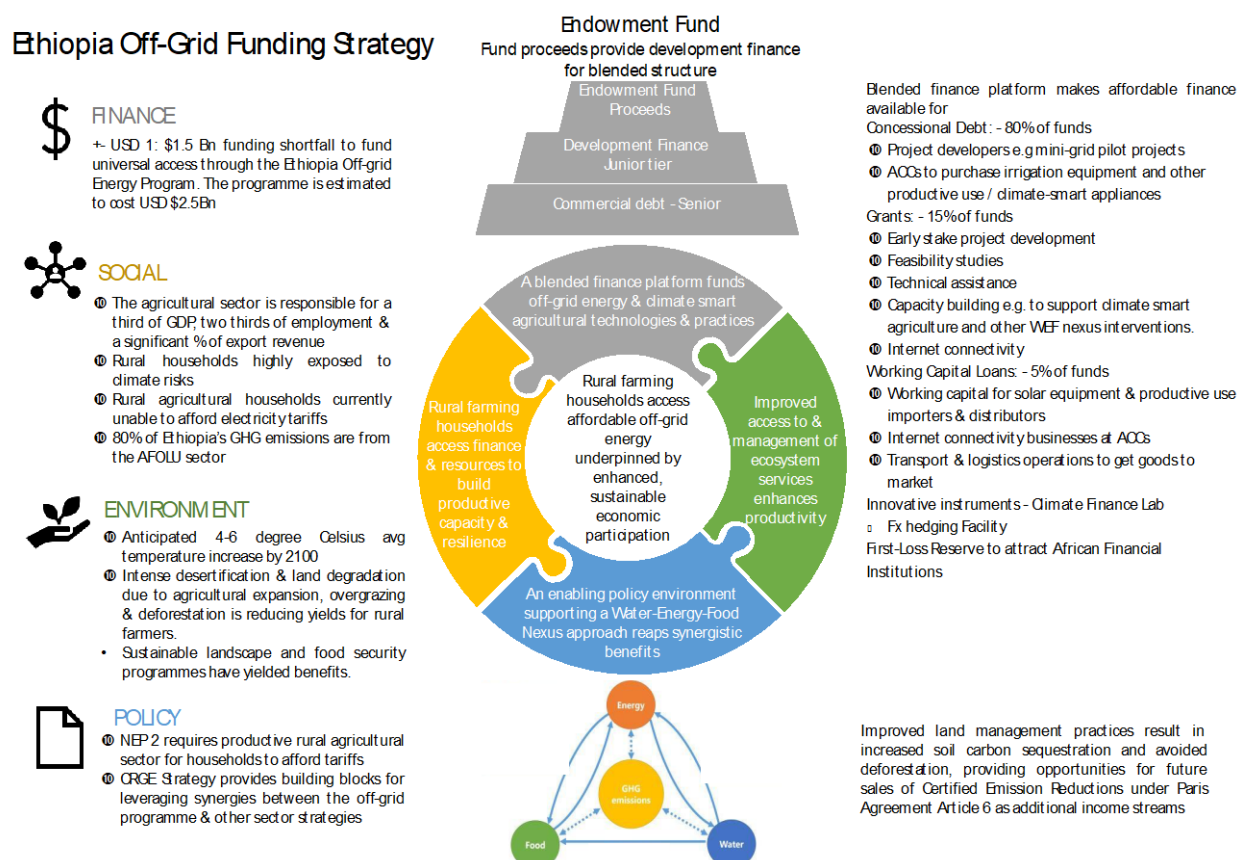


Figure 1: The funding strategy requires an integrated approach in order to address climate risks to the rural economy.

1.3. The Ethiopian Off Grid Programme

Ethiopia's policy agenda acknowledges the importance of sustainable development as a strategy to address poverty and environmental breakdown. Renewable energy powering the rural economy is a key element of the country's climate strategy and, importantly, there appears to be the political will to address the challenge. Policies to support sustainable development and climate action are backed up on the ground with wide ranging programmes that address sustainable land management and food security on a national scale.

Although the Ethiopian Government, with support of development partners, has made significant progress opening up the economy to private sector investment, a number of structural and regulatory barriers remain. Longstanding barriers from a structural perspective include Ethiopia's universal household electricity and grid connection tariffs which are heavily subsidised by Government. In the medium term Government is committed to a gradual increase in tariffs in real terms until they are cost reflective, however in the short term it remains a challenge to attract investors with unsustainably low tariffs. This has been partially addressed through an acceptance of higher tariffs for commercial mini-grid offtakers using the ABC business model¹ and the acceptance by Government that at many sites, particularly those in deep rural areas, more formal subsidies will be required. Widespread experience in the developing

¹ In Ethiopia, the ABC model - Anchor, Businesses and Community – is the preferred business model for private sector mini-grids. This model has the potential to address both the private sector's requirement for cost reflective tariffs as well as the government's requirements for household tariffs that are aligned with the uniform national tariff.

world supports the requirement for both supply and demand side subsidies as essential for countries to reach universal access.

The National Electrification Program (NEP 2.0) is a comprehensive implementation plan that aims to connect six million rural households through a combination of standalone solar home systems and mini-grids. Off-grid beneficiaries are grouped into short, mid and long-term off-grid customers, with the first two categories to be replaced by grid connections within the next decade. The ambitious scale of the off-grid programme requires bold targets to be set and in NEP 2.0, the government calls on all implementing partners including the private sector to get involved (Government of Ethiopia 2019). Because of the size and scope of the opportunity, private sector actors are engaged and leading international project developers have attended stakeholder events and registered interest in the pilot programme. However uncertainty exists, with financing remaining a significant barrier and access to affordable debt at scale still presenting a key challenge. The economic fallout due to the COVID-19 pandemic has added further uncertainty to the financing challenge.

The off-grid program is expected to cost in the region of USD \$2,5 Bn (Government of Ethiopia 2019). Donor agencies including the World Bank, African Development Bank (AfDB), FCDO and others have committed significant funding; Pre-COVID Government expected to fund a significant percentage of the programme through long term debt however this position may have changed with Ethiopia's fiscal position deteriorating due to the economic fallout from the pandemic and, as of the 4th quarter of 2020, a significant funding gap of between USD \$ 1 – 1.5 Bn remained.

1.3.1. Mini-grids

Over the past two years since NEP 2.0 was published, there has been shift towards increasing the planned number of mini-grids for the off-grid programme. Mini-grids are able to power commercial and industrial loads and if correctly designed, are able to provide 24/7 service, bringing a grid-like experience to places that are unlikely to be serviced with a reliable grid in the near future (Phillips, Attia and Plutsh 2020).

The Ministry of Water, Irrigation and Energy (MOWIE), has identified upwards of 500 potential sites, but envisages more than 3000 mini-grids across the country, including towns, villages and agriculture clusters where a minimum threshold of household density supports the cost of the infrastructure. This strategic shift has been driven mainly by a decline in mini-grid connection costs with recent estimates putting them lower than the cost of grid connections.

This report uses data from a prefeasibility study of eleven sites at Agriculture Commercialisation Clusters (ACCs) (Veritas Consulting 2020) to extrapolate metrics for the larger programmatic roll out. Notwithstanding the small sample and careful site selection, the study provides encouraging investment metrics for the financial viability at ACCs. Building momentum from successful implementation is important at this early stage and encouragingly a number of donors have stepped forward to provide derisking finance for the demonstration sites. Experience across the developing world indicates that almost all rural mini-grids require public funding, and securing private finance is challenging. Understandably MOWIE wants to collect data from the demonstration sites in order to understand key metrics before launching into a broader programmatic rollout that is likely to require a significant contribution of public finance.

In the region of USD \$900M in debt will likely be required for full implementation of the mini-grid programme based on the assumption of 3000 sites in total and an average capex cost of USD \$500,000

per site (see Table 5, Page 14)². As mentioned earlier, securing affordable debt will be a key challenge to close the funding gap. A number of important factors related to project financing and risks have emerged which are covered in more detail later in this report.

In summary key recommendations include the following: (i) A recent survey amongst African Financial institutions reveals an appetite for off-grid financing particularly if a first-loss cash reserve is available (G4A 2020). Affordable debt from local financial institutions would partially remove the foreign currency risk. (ii) Larger project developers can benefit from economies of scale which can lower costs and support the development of a funding platform to reduce the cost of debt. (iii) The mini-grid sites need to be consolidated into a phased pipeline of projects with cost optimisation, higher load factors and financial viability criteria playing a lead role in early phase site selection in order to build programme momentum. (iv) there is the potential to migrate innovative new instruments developed by the Climate Finance Lab. The FX Hedging Facility which reduces the total cost of hedging by efficiently utilizing public capital, has immediate application in Ethiopia and the Lab should be engaged to discuss implementing the Facility in Ethiopia. (v) Effective community engagement has been shown to reduce social risks which are a feature of many developing countries.

1.3.2. Solar Home Systems and Lanterns

The other component of the off-grid programme is made up of solar home systems and lanterns. By August, 2018, 1,2 m connections had been made (Government of Ethiopia 2019) which represents approximately 28% of the total connection target to be provided by off-grid solar solutions. Through a combination of formal and informal networks, import and distribution supply chains have been established and this component of the off grid programme appears to have developed momentum driven by market forces and support from the Market Development Credit Line (MDCL) at the Development Bank of Ethiopia. The MDCL has enabled the import of more than 850,000 quality verified products and also supports wholesale loans to microfinance institutions (MFIs) to provide consumer finance to end users. (Lighting Global 2020). A carbon finance component funds after sales service including battery replacement, warranty tracking and other operations and maintenance costs (Ci-Dev 2016).

A large percentage of households in rural areas have limited ability to pay and it is not surprising that a significant piece of the market is owned by companies providing cheaper alternatives that do not meet Lighting Global quality standards. There is an argument that efforts should be made to bring informal networks for solar lanterns and related products into the formal economy in order to ensure that quality certification is maintained while continuing to harness the momentum built by entrepreneurs and innovators in the sector.

1.3.3. Clean Cooking

Alongside other energy services, clean cooking is increasingly viewed as an urgent development issue with significant benefits for public health, gender equality, the local environment, and the global climate agenda. The International Energy Agency defines a household as having energy access when it has reliable and affordable access to both clean cooking facilities and electricity, which is enough to supply a basic bundle of energy services initially, and with the level of service capable of growing over time. While the National Improved Cookstove Programme (NICSP) has made significant progress in the distribution of

² The average capital cost for the eleven demonstration sites is \$830,000. However, according to analysts involved in the programme, these are considerably larger than the average site. We have been advised to use an average capital cost of USD \$500,000 per site.

improved cookstoves, the continued use of traditional biomass including wood, charcoal and dung in households accounts for roughly 90% of total primary energy use in Ethiopia and is associated with deforestation, land degradation and greenhouse gas emissions and the resulting indoor household air pollution is responsible for hundreds of thousands of premature deaths a year, predominantly amongst women and children. Apart from a few exceptions, pure market based approaches have struggled to deliver the scale and reach required to make meaningful progress in the clean cooking sector and nearly all clean fuel and stove programs involve some form of performance-based incentive or subsidy. Interventions in the clean cookings sector fall into two broad categories: (i) improving sustainable rural biomass supply and (ii) technology innovations including biomass-to-energy innovations such as ethanol stoves and efficient electric cookers.

1.4. Leveraging the Off-Grid Programme to deliver Nexus Benefits

Affordability of services by rural households is a fundamental component of the business case for private investors. A functioning rural economy, which is under threat from climate change, requires climate risks to be addressed at all levels of government. This report argues that a water-energy-food nexus approach, as opposed to a pure focus on energy, will drive an improved policy response to climate risks by addressing cross-cutting challenges of climate change and will deliver more integrated outcomes. Although this approach has not been fully mainstreamed, there are immediate benefits to the rural economy in Ethiopia.

Over the next decade the off-grid programme will reach out to more than six million rural households as the Ethiopian Government rolls out universal access. The majority of rural households depend on agriculture for their livelihoods and mini-grids installed at farming clusters will support agricultural productive uses. A significant project planning and logistics effort will be required to build capacity for a number of related activities including first mile logistics, mobile money payments, productive use equipment sales, solar system installation, operations and ongoing maintenance. By introducing landscape interventions and climate smart farming practices as part of a capacity development package, the outcome will be a more integrated water-energy-food nexus intervention that directly addresses development pathways outlined in the CRGE and NDC. This will help to de-risk the off-grid programme. In addition the scaled up carbon benefit can either be monetised to provide a hard currency revenue stream or can contribute towards the country's ambitious NDC mitigation targets.

The GCF funded 'Sustainable Landscapes in Eastern Madagascar' is a nexus case study that may provide lessons for Ethiopia. It engages both public and private sector actors to build an enabling environment to crowd in both international investment and domestic private sector resources by removing investment barriers, and introducing tax incentives for renewable energy and support for public private partnerships (PPP). This case study is relevant to Ethiopia's off-grid programme as it combines actions in both agriculture and energy sectors and has the potential to mobilize large scale private investment. (GCF 2017)

Key recommendations are as follows: (i) Formation of an inter-ministerial working group to address challenges and leverage opportunities that arise from the off-grid programme. (ii) Policy formulation related to the water-energy-food nexus needs to be informed by the latest scientific evidence. (iii) Look for overlaps, linkages and development opportunities to include and scale existing landscape and watershed programmes. In particular opportunities to embed climate smart agriculture practices as part of the capacity development programme for the off-grid sector utilising Ethiopia's far-reaching agriculture

extension service network, will reap benefits. (iv) Cooperation among all decision-makers particularly around investment decisions is critical, particularly as demand for scarce resources continues to grow. (v) Evaluate risk pooling services to provide insurance pay-outs to smallholder farmers. (vi) Integrating gender issues makes it more likely that the project will have a substantial impact on household and community poverty reduction and (vii) enable communities with internet connectivity so that they can improve access to markets, receive climate information services including weather forecasts and access knowledge and best practice.

1.5. Establishing an Endowment Fund

In Section 0 on page 29 the report advocates for the establishment of an off-grid energy endowment fund for Ethiopia. The envisaged endowment fund would address important financing gaps which currently constrain African infrastructure viz concessional debt at longer tenor commitments and early stage project financing, and could be formalised into a blended funding platform, leveraging significant additional commercial capital. Importantly it could also provide a first-loss reserve to attract funding from African financial institutions (Greenmax 2020). In return it would deliver impact as well as capital preservation to investors. Recently endowments have started to be used as funding instruments for environmental and climate change projects. A current example in sub-Saharan Africa is the endowment fund set up to support sustainable development in the Cubango-Okavango River Basin (CORB). A more ambitious endowment fund was established in Germany in 2019 by a group of international investors and entrepreneurs in response to the climate crisis. The aim of the Climate Endowment³ is to provide a platform for institutional investors to allocate more of their huge capital stock to renewable energy, new mobility and related clean-tech assets. It aims to provide an attractive solution for EU pension funds and insurance companies to invest in clean energy companies and other companies that have significant climate mitigation potential.

Due to underdeveloped capital markets, fund managers wanting to diversify portfolios and invest in African infrastructure are unable to invest in liquid stocks and bonds of infrastructure companies, municipalities or projects in public exchanges because they largely don't exist. Developing a robust African investment portfolio requires patience and local knowledge which is beyond the scope of most fund managers in North America and Europe. Contrary to what many believe, the default rate of African investment projects is lower than similar projects in many developed market regions (for example, North America) and a significantly lower default rate than many other emerging market regions such as Latin America and the Caribbean (Moody's Investors Service 2018). Supporting the high level design proposed in this report is the fact that infrastructure investments are often positioned as inflation hedge investments in an asset manager's portfolio. The proposed endowment fund will provide exactly such a capital preservation outcome.

Investment in renewable energy projects in Sub-Saharan Africa would provide alignment with the Paris Agreement and the SDGs and will also generate the type of impact that fund managers are looking for in line with emerging ESG good practices.

Establishing the fund is likely to cost in the region of USD \$500,000 - \$700,000 and will take at least 36 months to design, implement, fund raise and operationalise.

³ <https://climate-endowment.com/>

1.6. Carbon Markets

Section 6 on page 37 provides a high-level overview of the opportunities for carbon and climate finance. The funding approach outlined in this report does not preclude the use of climate and carbon finance. Carbon revenues function best as a results-based funding component and in that respect, are complementary with the other approaches proposed in this report. At this stage it is difficult to see carbon finance playing anything more than a supporting role for the off-grid programme. This is informed by (i) the ambitious emissions targets contained in Ethiopia's NDC means it is uncertainty whether Government will trade ITMOs, (ii) lack of an operational countrywide MRV system, (iii) current lack of clarity around the rules of Paris Agreement Article 6, (iv) experiences with current CDM projects that have underdelivered in terms of carbon benefit, (v) and the fact that the carbon market is depressed at current prices.

Multiple approaches and sources of funding are required and carbon and climate finance are important pieces of the funding mix. The process of securing climate finance requires a long lead time and success is not guaranteed. Applications to the Green Climate Fund (GCF) are in process to fund elements of the off-grid programme and these complementary initiatives will help to address the funding gap if successful. Specific project proposals supporting the implementation of the off-grid program could utilise funds from the blended finance platform as co-financing to support a proposal for climate finance from the GCF.

In spite of significant traction in Asia and Latin America, the Clean Development Mechanism has had limited success in Africa. Projects have struggled to deliver the expected carbon benefits and revenue, likely due to capacity gaps in implementation. There is an opportunity to pilot a water-energy-food nexus approach in Ethiopia as discussed above, which, if done at scale, has the potential to address climate risks to the rural economy as well as deliver a significant carbon benefit. Encouraging landscape project case studies are emerging in Sub-Saharan Africa. A current example is the Kariba REDD Project in Zimbabwe established by consulting firm, Southpole.com, and is one of the largest registered REDD+ projects worldwide. A recently published paper reviewing the mitigation benefit of the Productive Safety Nets Programme (PSNP) estimates a total reduction in net GHG emissions at the national scale of 3.4 million Mg CO₂e per annum. This is approximately 1.5% of the emissions reduction targets in Ethiopia's Nationally Determined Contribution (Woolf, Solomon and Lehmann, Land restoration in food security programmes: synergies with climate change mitigation 2018). The PSNP offers a tangible demonstration of the multiple benefits that emerge when taking an integrated approach, one that provides lessons to inform the development and scaling up of future landscape interventions. These projects are complex to implement and manage but due to their high socio-economic impact on local communities, carbon benefits attract a premium price on the voluntary market.

Looking forward, the final details for the Article 6 rulebook have been moved to COP 26 in Glasgow in 2021. Under the Paris Agreement, emission reductions are national assets and the GoE will need to evaluate whether to trade emissions reductions or have them account towards their domestic NDC targets. Ethiopia will need to significantly reduce emissions from the AFOLU sector in order to meet its NDC mitigation targets and this requires fundamental changes to agriculture and the management of natural resources, particularly improved conservation of forest and natural ecosystems. This is a significant challenge that will require scaling of current landscape management programmes and the adoption of a nexus approach including widespread climate smart agriculture interventions.

1.7. Additional Information

Additional information is provided in the body of this report below, as well as in six Annexes to this report, namely:

- Annex 3 (Section 9, Page 45) covers funding & support resources related to the off-grid sector in Sub-Saharan Africa.
- Annex 4 (Section 10, Page 47) provides a list of Instruments from the Climate Finance Lab that are pertinent to Ethiopia. It is possible to migrate these instruments to Ethiopia and this will require engaging with the Lab. In particular the Fx Hedging Facility looks to have immediate application.
- Annex 6 (Section 12, Page 52) provides a high-level model view of the endowment fund for illustration purposes. The assumptions will need to be tested in more detail during a design phase.

2. Introduction

2.1. Ethiopia - Highly Vulnerable to Climate Change

More than 80% of Ethiopia's population reside in rural areas and are dependent on natural resources for their livelihoods. The agriculture sector is responsible for a third of GDP yet accounts for two-thirds of employment and a significant percentage of Ethiopia export revenue. As a result, climate change represents a significant risk to the country's development agenda.

Changing rainfall patterns and rising temperatures are already impacting water availability and food security, threatening the rural economy. In current emissions trajectories the budget to keep warming below 2°C will be exceeded within approximately two decades (IPCC, 2014a) and the IPCC representative concentration pathway RCP8.5 (a scenario of continued high emissions) indicates that temperatures in East Africa are projected to rise between 4°C and 6°C by 2100 (IPCC, 2014b). It is unclear whether the increased frequency of droughts seen over the past 30 years will persist however increases in the frequency and intensity of heavy rainfall are predicted with high certainty (Zbigniew and Kanae 2014).

As with other countries in sub-Saharan Africa, land resources in Ethiopia are facing intense degradation, defined as the long-term loss of ecosystem services, due to deforestation, soil quality degradation and erosion, agricultural land expansion and overgrazing. Recent estimates suggest that the area of degraded land in Ethiopia exceeds one-quarter of the total surface area of the country, affecting nearly one-third of the population (Gebreselassie, Kirui and Mirzabaev 2016) and is responsible for the majority of the country's greenhouse gas emissions. Degraded landscapes impact directly on household livelihoods and the rural economy by reducing agricultural productivity and crop yields. The negative feedback loop of climate change driving declining agriculture productivity and further landscape degeneration therefore represents a significant risk to the rural economy and also is a major risk to NEP 2.0's off-grid program which relies on a productive rural agricultural sector in order for households to afford tariffs.

Initiatives to reduce the vulnerability of communities, the environment and the economy are detailed in Ethiopia's Climate Resilient Green Economy (CRGE) Strategy which outlines pathways to achieve resilient economic development. Although Ethiopia's CRGE initiative follows a sectoral approach, agricultural productivity, renewable energy and access to water for irrigation and drinking are fundamental building blocks that enable the strategy. Addressing these building blocks in a systemic manner by adopting a water-energy-food nexus approach can deliver outcomes that address both climate adaptation and mitigation indicators in an integrated manner. The first step in the process is for cross-sectoral dialogue between the relevant ministries. Leveraging synergies and linkages between the off-grid programme and existing natural resource management programmes will result in improved outcomes.

2.2. The Scope of The Ethiopian Off Grid Programme

This section summarises the main components of the off-grid programme and includes relevant details in terms of a funding strategy. For a full explanation, readers are encouraged to read The National Electrification Programme 2.0.⁴

⁴ NEP 2.0 is available at this URL: <https://minigrids.org/wp-content/uploads/2019/04/Ethiopia-2.0.pdf>

Ethiopia occupies an important role in East Africa and its policy commitment to sustainable development has received consistent international support. The country's climate change strategy, the CRGE, includes renewable energy as an enabler of the rural economy. Universal access to electricity is also one of the key developmental objectives of the Ethiopian Government in their drive to middle income status. The ambitious targets contained in the National Electrification Plan (NEP 2.0) aim to provide 60 million people with access to electricity access over the next decade, with geospatial mapping of power infrastructure and overlays of towns and villages used to identify the least cost approach to providing services.

The off-grid programme beneficiaries are segmented according to their distance from existing grid infrastructure into the following two groups:

1. About 1 million households located in deep rural areas defined as more than 25 km from the grid, will remain reliant on off-grid solutions post 2030. This group is referred to the long-term off-grid.
2. About 5 million households, growing to 7.8 million by 2030, located between 2.5 km and 25 km from the grid will initially receive off-grid solutions that will be replaced by the grid when it arrives. This group is called the mid-term pre-electrification group.

NEP 2.0, published in 2019, references plans to develop 285 mini-grid sites providing connections to 210,000 households and leaves open additional scope for mini-grid development. Over the past two years since NEP 2.0 was published, there has been shift towards increasing the contribution by mini-grids. The Ministry of Water, Irrigation and Energy (MOWIE), has identified upwards of 500 potential sites, but envisages more than 3000 mini-grids across the country, including villages, towns and agriculture clusters where a minimum threshold of household density supports the cost of the infrastructure. This strategic shift has been driven by a significant decline in costs for mini-grids with recent estimates at USD \$600 per connection which is significantly lower than grid connections. In addition, once the grid arrives in a mini-grid-powered village, the existing distribution infrastructure allows for rapid connection to the grid with the private-sector developer's investment protected by a clear set of "grid-encroachment" guidelines.

The rollout strategy will be to support a limited pilot site implementation leading to scale out once lessons have been learned and supporting data collected to inform decision-making, with the Government funding a large percentage of the programme through USD denominated sovereign debt. Speed of delivery needs to be balanced with a learning approach to ensure efficient use of scarce resources.

An important factor favoring mini-grid electrification, which supports ESMAP Multi-Tier Framework (MTF)⁵ access at Tier 3 and above, is the enhanced opportunity for commercial or productive use of electricity. The primary commercial use case identified at this stage is for ground water pumping and irrigation which is expected to more than double land under irrigation, and boost agriculture productivity and the rural economy. Other agriculture productive uses include cold storage and various forms of processing with the aim to grow the export market with the route to market through Djibouti and the Gulf.

Apart from Agriculture Commercialisation Clusters (ACCs), three other national programmes have potential for productive use of electricity to support mini-grid investment but are not far enough advanced at this stage. They are (i) Milk Collection Centers run by USAID and Ministry of Agriculture (ii) Integrated Agro-Industry Parks run by the Ministry of Trade and Industry and (iii) the Woreda Transformation Plan which is designed to be run cross-sectorally (Veritas Consulting 2020).

⁵ ESMAP, under the SE4ALL initiative, in consultation with multiple development partners has developed the Multi-tier Framework (MTF) to monitor and evaluate energy access by following a multidimensional approach.

MoWIE will now focus the majority of their resources and energy to achieving the updated mini-grid targets by 2030, and a larger role by the private sector is envisaged to help achieve the targets. This creates a significant commercial opportunity for international private developers who are able to operate at scale and have the reach, risk appetite and access to a funding platform. However the challenge is considerable. Currently there are only a handful of functioning mini-grids in Ethiopia with no commercially viable sites operating at present and financing, in particular affordable debt, remaining a key challenge.

2.2.1. Mini-grid Demonstration Projects at ACCs

During 2019, as an output of Mobilising Investment, SouthSouthNorth (SSN) together with Ethiopian partners Veritas Consulting, undertook a prefeasibility study of eleven mini-grid sites located at agriculture commercialisation clusters (ACCs) in Oromia, Amhara, Tigray and SNNP⁶. Although a small sample, these sites provide a useful datapoint from which we can extrapolate key metrics for a more widespread programme.

The eleven sites were selected in consultation with MoWIE and with recommendations from the Agriculture Transformation Agency (ATA). The parameters for site selection included a minimum of 100 horticulture farmers within a potential mini-grid catchment area and a community that was amenable to private investment (Veritas Consulting 2020). ACCs focused on horticulture crops (tomato, onion, banana, mango, and avocado) were selected for two reasons; horticulture crops have significant requirements for power-dependent irrigation and the revenue generation potential makes horticulture ACCs suitable mini-grid anchor off-takers. On average, three quarters of the farmers at each site currently use diesel generators to power irrigation pumps and the water source is either ground water or from perennial rivers.

The table below provides a summary of key data points for each of these sites including capital investment requirements and returns under different three scenarios with different tariff structures.

	Sites	Est. PV Rating (KWp)	Est. Battery Rating (KWh)	Power System CAPEX	Distribution CAPEX	Total Capex	Distribution \$ / Connection #	Hectares Under Irrigation	Households	IRR - different scenarios		
										Scenario 1	Scenario 2	Scenario 3
1	Toli Kersu	190	258	\$ 321,070	\$ 143,147	\$ 464,217	208	43	652	0	0	0
2	Chefe Kora	142	48	\$ 173,643	\$ 110,431	\$ 284,074	597	51	178	15.1%	16.1%	17.4%
3	Huluku	182	113	\$ 245,686	\$ 104,302	\$ 349,988	462	65	220	11.1%	11.9%	10.2%
4	Alege	338	129	\$ 419,857	\$ 109,120	\$ 528,977	453	121	234	18.8%	19.6%	21.1%
5	Damba	141	48	\$ 172,129	\$ 82,864	\$ 254,993	351	50	228	14.7%	16.2%	16.8%
6	Tankua	1,343	81	\$ 1,467,851	\$ 122,978	\$ 1,590,829	331	478	358	25.1%	25.6%	27.7%
7	Telifa	1,279	64	\$ 1,392,306	\$ 83,938	\$ 1,476,244	273	455	300	26.8%	27.2%	30.0%
8	Kuleta	638	64	\$ 709,161	\$ 69,105	\$ 778,266	152	227	451	25.5%	26.8%	30.2%
9	Laelay adie	220	32	\$ 249,202	\$ 82,372	\$ 331,574	371	79	220	17.5%	18.5%	19.4%
10	Murche	458	48	\$ 510,740	\$ 89,286	\$ 600,026	209	205	420	23.8%	25.3%	28.7%
11	Lelicho	2,163	113	\$ 2,356,690	\$ 101,910	\$ 2,458,600	310	337	312	27.4%	27.7%	30.3%
	Total	7094	998	\$ 8,018,335	\$ 1,099,453	\$ 9,117,788	3717	2111	3573			
	Average	645	91	\$ 728,940	\$ 99,950	\$ 828,890	338	192	325	20.6%	21.5%	23.2%

Table 1: Summary data from a sample of 11 potential sites at horticulture ACCs (Veritas Consulting 2020).

⁶ The prefeasibility report is available at https://southsouthnorth.org/portfolio_page/mobilising-investment-for-ndc-implementation/

		Scenario 1	Scenario 2	Scenario 3
CAPEX subsidy / Result Based Financing	% CAPEX	0	0	43
OPEX subsidy	% OPEX	0	0	0
Household installation fee	ETB	1000 (\$30)	5000 (\$151)	5000 (\$151)
Household energy charge	ETB/kWh	2.2 (\$0.067)	2.2 (\$0.067)	2.2 (\$0.067)
Business installation fee	ETB	1000 (\$30)	5000 (\$151)	5000 (\$151)
Business energy charge	ETB/kWh	5 (\$0.15)	5 (\$0.15)	2.2 (\$0.067)
Irrigation (anchor) energy charge	ETB/kWh	6 (\$0.18)	6 (\$0.18)	2.2 (\$0.067)

Table 2: Subsidies, installation charges and tariffs under the three different scenarios in Table 1 (Veritas Consulting 2020).

Tranche	Currency	% of capital	(Target) Return/Cost	Tenor (year)
Equity – developer	USD	10%	20% (including carried interest)	10
Equity – investor	ETB	30%	25%	10
Local Debt	ETB	20%	12%	~10
Concessionary debt	GBP	40%	5%	~10

Table 3: Capital structure based on a BOOT scenario with a 10-year lifetime, and the debt drawdowns are based on actual expenditure, hence the tenor being approximate (Veritas Consulting 2020).

Parameter	Input Value	Rationale
ETB/USD, exchange rate	33	The birr depreciates fairly steadily against USD; the analysis should be updated periodically to account for such changes.
ETB depreciation vs USD	10%	There is a significant risk of ETB depreciation against USD, with the growth of the Ethiopian economy and ongoing short trade balance.
Tariff increase, non-irrigation	7%	Inflation in Ethiopia is currently around 15%. We expect that full passthrough of inflation may face some resistance from the GoE.
Tariff increase, irrigation	5%	We believe that it is fair to reduce the relative amount of cross-subsidization over time.

Table 4: Exchange rate and annual tariff escalation variables modelled for the pilot programme.

2.2.2. Mini-grid Programme Conclusions

Care must be taken when drawing conclusions from a small sample of sites however this is, to our knowledge, the most recent set of published data with which we can draw conclusions about the broader programme.

1. The ABC model appears to support financial viability for most of these sites with an average IRR > 20% based on the capital structure illustrated. A high number of households and relatively small area under irrigation, reduces the financial viability of the site. The reason is due to tariff structuring under the ABC model i.e. irrigation tariffs are at commercial rates and effectively subsidise households which are charged at the uniform national tariff rate. Sites with fewer commercial customers and a higher proportion of households will require further subsidies and/or increased percentage of concessional debt in the capital structure.
2. For the pilot programme, the average infrastructure cost are USD \$ 830,000 per site. In discussion with stakeholders involved in the programme, the sites selected for the pilot programme are larger than the average. Notwithstanding, 3000 sites represents a significant multi-billion dollar investment opportunity, with access to affordable debt being the most pressing financing challenge.
3. Using the capital structure outlined in Table 3 above and a programme goal of 3000 sites, the Table below provides an indication of the total funding required in each class of debt and equity. A key assumption is that the average cost of each site is \$500,000 which is significantly lower than the average capital cost of infrastructure for sites in the Veritas pilot programme. An important observation in the table below is that a significant percentage of the funding – USD \$525M – comes from local sources.

	Assumptions	Phase 1	Phase 2	Total
Sites	3,000	500	2500	3000
Average Capex /site	\$ 500,000			
Foreign Equity (% of total)	20%	50,000,000	250,000,000	300,000,000
Local Equity	20%	50,000,000	250,000,000	300,000,000
Local Debt	15%	37,500,000	187,500,000	225,000,000
Concessionary Debt	45%	112,500,000	562,500,000	675,000,000
Total Capex		\$ 250,000,000	\$ 1,250,000,000	\$ 1,500,000,000

Table 5: Indicative funding totals in USD for widespread mini-grid program consisting of two phases, and capital structure based on the pilot programme outlined in the Veritas Report.

4. MoWIE have indicated that the Ethiopian Electric Utility (EEU) is likely to fund the distribution infrastructure for many of the sites. In this case, the extra cost for grid compliant distribution infrastructure will be borne by Government, making connection to the main grid easier when it arrives.
5. The current or business as usual situation is that the majority of farmers use diesel-powered irrigation, indicating a significant carbon benefit from implementing solar-powered mini-grids.
6. The variability of returns in this small sample supports the concept of a limited number of project developers with a larger portfolio of sites so that they are able to manage risk across a portfolio and benefit from economies of scale both in terms of funding and equipment supply.

2.2.3. Off-grid Solar Solutions

The other component of the off-grid programme is made up of off-grid solar solutions. By August, 2018, 1.2 m connections had been made (Government of Ethiopia 2019) which represents approximately 28% of the total connections estimated to be provided by off-grid solar solutions. Through a combination of

formal and informal networks, import and distribution networks have been established driven by market forces and support from various programmes.

Lighting Global divides this category into three groups:

1. Pico are lowest cost of entry, small portable solar lanterns designed to meet basic lighting requirements as a replacement for kerosene lamps. They have an integrated solar panel up to 10 Wp, an internal rechargeable battery and some have USB charging for portable phones. The majority of pico systems in Ethiopia are rated below MTF Tier 1.
2. Solar home systems can be plug and play or assembled from components. They have a solar panel of 11 Wp or higher and can power multiple lights as well as home appliances. In Ethiopia, 90% of these systems are rated at MTF Tier 1.
3. Solar appliances are energy efficient and powered by direct current and include household appliances such as refrigerators and productive-use appliances such as water pumps and cold storage.

NEP 2.0 provides clear policy guidelines for the use of solar home systems and lanterns as both a transition technology as well as a long-term solution in the country's pathway towards universal access. Many households in rural areas have limited ability to pay and it is not surprising that a significant piece of the market is owned by companies providing cheaper alternatives that do not meet Lighting Global quality standards. This is a challenge seen in many developing countries and carries the risk that poor quality equipment erodes consumer confidence. In response, quality standards have been adopted, trade barriers addressed and tax incentives implemented to support the import of affordable high quality products. Good progress in terms of connection numbers has been made and consumer awareness of the importance of quality has been growing. (Lighting Global 2020)

For equipment importers into Ethiopia, access to foreign exchange is a challenge that limits the growth of the market. In response, a USD \$40m credit facility was established at the Development Bank of Ethiopia in 2013 with support from the World Bank and Lighting Africa. A carbon finance component funds after sales service including battery replacement, warranty tracking and other operations and maintenance costs (Ci-Dev 2016). The Market Development Credit Line (MDCL) has enabled the import of more than 850,000 quality verified products and also supports wholesale loans to microfinance institutions (MFIs) to provide consumer finance to end users. (Lighting Global 2020).

Additional funding may be needed for the MDCL to support growth of imports of verified products and capacity building and technical assistance will be needed to help key Government agencies bring informal sector networks into the verified supply chain.

Low population density in deep rural areas and the extended supply chains to service customers adds additional cost. NEP 2.0 references a Minimum Subsidy Tender (MST) implementation mechanism combined with Results-Based Financing to incentivise the private sector to service these areas. (Government of Ethiopia 2019). Implementation of the MST will require technical assistance and capacity development support. Lighting Global affiliates, OEMS or donors are possible funders for this work.

Finally pre-feasibility studies will be needed to analyse the financial viability of scaling up local manufacture and/or assembly of solar lanterns in-country. At this stage of the market development, a reliable supply of affordable products that meet quality standards is key to continued growth.

2.2.4. Clean Cooking and the Challenge of Unsustainable Biomass Use

The purpose of this section is to highlight the need for sustainable cooking solutions as an important part of the off-grid programme. There is an opportunity to leverage the off-grid programme to continue to drive and scale the National Improved Cookstove Programme (NICSP) whilst addressing efforts to improve the supply of sustainable rural biomass.

The use of traditional biomass including wood, charcoal and dung in households accounts for roughly 90% of total primary energy use in Ethiopia; about 84% and 99% of urban and rural households, respectively, rely on biomass as their primary cooking fuel (Johnson and Mengistu 2013).

The International Energy Agency defines a household as having energy access when it has reliable and affordable access to both clean cooking facilities and electricity, which is enough to supply a basic bundle of energy services initially, and with the level of service capable of growing over time. Clean cooking is increasingly viewed as an urgent development issue with significant benefits for public health, gender equality, the local environment, and the global climate agenda. It is well documented that the use of biomass, both as fuelwood and as charcoal, is associated with deforestation, land degradation and greenhouse gas emissions and the resulting indoor household air pollution is responsible for hundreds of thousands of premature deaths a year, predominantly amongst women and children. The COVID pandemic has highlighted the interlinkages between traditional cooking, gender, health, and the environment. Improved and clean cookstoves are an important intervention that have seen traction in many parts of Africa however more comprehensive solutions are required that can reduce the increasing pressure of harvesting fuel wood from ecosystems as the population increases in size.

Modern Energy Cooking Services (MECS) draws on the approach of the World Bank's Multi-Tier Framework (MTF) for cooking and uses a six dimension framework to evaluate progress towards clean cooking. According to the definition, only 10% of households in SSA have access to MECS (World Bank 2020).

Under the CRGE, the National Improved Cookstove Programme (NICSP) has been identified as a priority initiative. From 2010–2015, the NICSP distributed almost 9 million improved cookstoves in the country, and by 2020 the Government targeted the distribution of almost 12 million extra cookstoves. (Government of Ethiopia 2019). MOWE has played a lead role overseeing the ICS programme and implementation draws on regional centres to interface with communities.

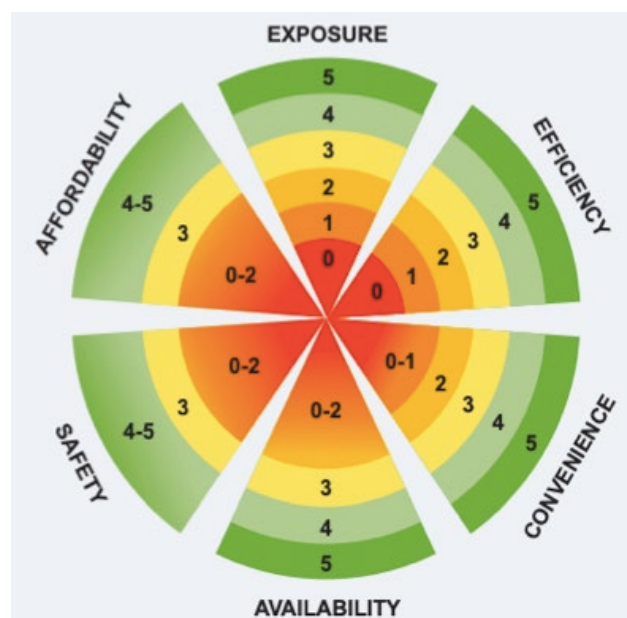


Figure 2: The six dimensions of Modern Energy Cooking Services (MECS) (World Bank 2020).

In terms of private sector progress, pure market based approaches have struggled to deliver the scale and reach required to make meaningful progress in the clean cooking sector and most businesses in the space remain small and unprofitable. Private investors see the market as inherently risky and public support for initiatives is needed to drive change. Research indicates that nearly all clean fuel and stove programs involve some form of performance-based incentive or subsidy. (World Bank 2020). Carbon

finance deployed as results-based financing mechanism has been used effectively in Ethiopia and elsewhere to fund the growth of the sector. Policies are needed to stimulate the investment in sustainable biomass and to encourage the broad distribution of improved fuel stove technologies to rural households. Good practices include policies that strengthen rural livelihoods and are resilient to climate change while ensuring local food security, promoting efficient use of available water and soil nutrition, and contributing to biodiversity and ecosystem conservation (Irena 2018).

IRENA provides a useful framework for policy makers by categorising interventions into three groups as follows (Irena 2018) :

1. Improving sustainable rural biomass supply includes gender approaches, agro-ecological practices to boost the availability of bioenergy feedstocks including agroforestry, participatory forest management and catchment management.
2. Biomass-to-energy innovations includes microdistillers for ethanol supported by Project Gaia, gasifier cook stoves produce energy cooking as well as producing biochar which can be added to soil to improve fertility and sequester carbon. Emerging Solutions include the following:
 - a. Ethanol cook stoves: ethanol is gaining wider recognition as a source of fuel. Project Gaia is working to build a commercially viable household market for alcohol-based fuels in Ethiopia and other countries and the business includes microdistillers for ethanol.
 - b. KOKO Networks in Kenya is promoting the use of bioethanol as a clean cooking solution for the urban poor and has successfully launched 700 distribution points across Nairobi.
 - c. Efficient electric pressure cooker stoves have proven successful for mini-grid sites in rural Kenya.
3. Tools to enhance bioenergy sustainability include the use of geographic information system (GIS) analysis to determine supply and demand potential, methods to enhance financial sustainability and inclusive participation, as well as digital financing systems and entrepreneurship supports in rural areas.

Organisations and funders in the clean cooking space

- World Bank & ESMAP: The Efficient, Clean Cooking and Heating (ECCH) Program is driving the World Bank's clean cooking agenda. The ECCH Program has played a catalytic role in raising concessional financing to leverage public and private investments in the sector. It supports lending projects and the enabling environment through technical assessments (TA), capacity building activities, and developing roadmaps to inform government policies and strategies.
- Project Gaia (<https://projectgaia.com/>) facilitates the transition to clean sustainably produced liquid fuels, including methanol and ethanol in many countries in SSA. In Ethiopia Gaia is working with local private sector partners to scale up ethanol and ethanol cookstove production and distribution across Ethiopia, including the development of four micro-distilleries.
- Rsb.org: The Roundtable on Sustainable Biofuels (RSB) is an international initiative. The RSB Principles & Criteria for Sustainable Biofuels provides guidelines on best practice in the entire biofuel value chain and addresses important issues such as food security, gender and livelihoods for the rural poor. A recent report by RSB provides a roadmap for the development of a sustainable biofuels industry.

The following policy recommendations will support the growth of a clean cooking sector in Ethiopia:

1. Continued support for the National Improved Cookstove Programme (NICSP).
2. Leveraging community engagement and capacity development for the off-grid programme to distribute improved cookstoves. New innovative solutions such as ethanol stoves and efficient electric pressure stoves should be piloted as part of a package of interventions.

3. More explicit reference to clean cooking targets in key policy documents will help to build support for the programme.
4. Support for the implementation of the National Biofuels policy. Biofuels have the potential to meet a significant proportion of the national energy need and address critical shortage of foreign currency by reduction of petroleum products.
5. Support for green fiscal incentives that zero-rate VAT and remove import taxes on ethanol stoves, efficient electric pressure cookers and fuels such as ethanol will stimulate the growth of the market.
6. Charcoal production for urban consumption is a driver of forest degradation in rural areas. Availability of affordable clean cooking fuel alternatives in urban centers can reduce the demand for charcoal and help to address a significant driver of deforestation.
7. Support piloting of clean cooking alternatives at mini-grid sites eg ethanol stoves, new efficient electric pressure cookers.

Case Study:

KOKO (<https://kokofuel.com/>) is a Nairobi-based technology and energy company that is pioneering the use of ethanol as a clean cooking alternative for the urban poor in Kenya. The company has raised significant amounts of private capital from international investors, and has developed a technology-enabled distribution network to deliver ethanol to hundreds of automated ethanol distribution points – KOKOpoints - around Nairobi. A partnership with Vivo Energy, Shell's exclusive licensee in Kenya, ensures that KOKOpoints do not run out of ethanol. Customers are able to purchase as little or as much ethanol as they can afford from the KOKOpoint using Mpesa mobil money. Ethanol which burns with a smokeless and odourless flame, can be manufactured from various feedstocks including sugarcane and cassava. Currently most of the ethanol used by KOKO is imported however once demand has been established, there is an opportunity for a significant local upstream ethanol manufacturing opportunity which will create jobs and added income for small holder sugarcane farmers.

KOKO is currently lobbying the Government of Kenya to reduce import taxes and VAT on ethanol and ethanol cookers in order to lower the barriers to entry for KOKO's customer base to purchase cookers and ethanol. KOKO is an example of a private sector clean cooking initiative that has the potential to bring about transformational change at scale.

2.2.5. The Off-grid Funding Gap

NEP 2.0 puts the cost of the off-grid program at USD \$2.5Bn. The figure below indicates the various committed funding packages with the current funding gap being in the region of USD 1Bn.

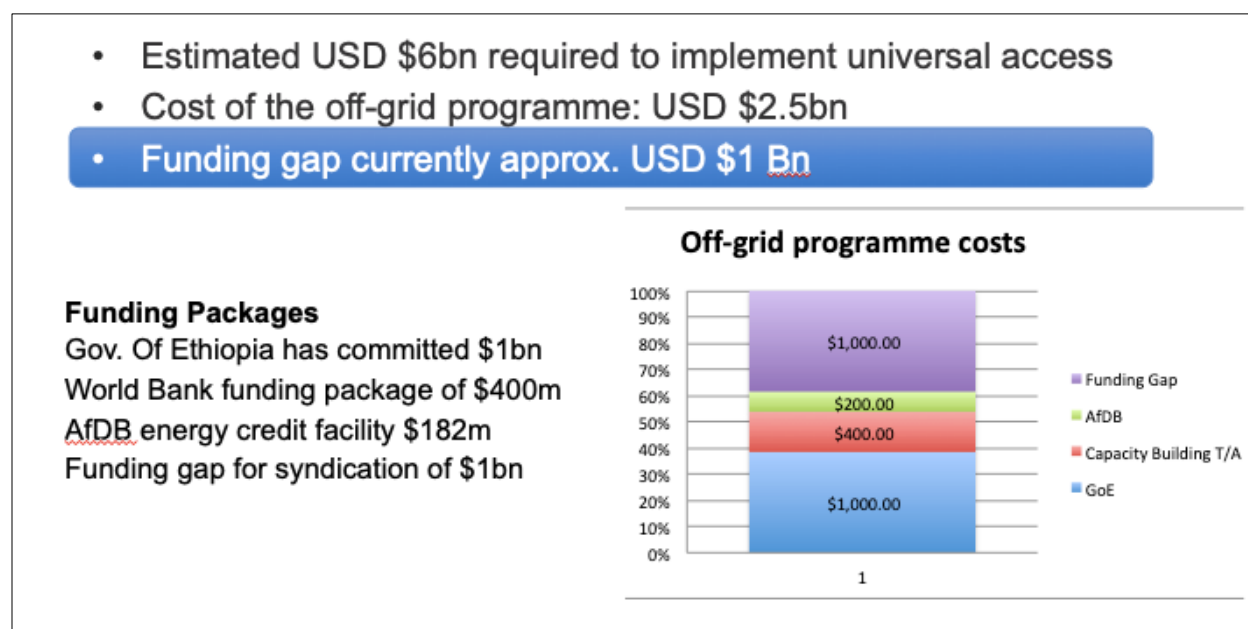


Figure 3: The off-grid funding gap.

Summary of Policy and Financial Instruments

The table below summarises the policy and regulatory support and financial instruments across the various components of the off-grid programme. (Government of Ethiopia 2019)

	Policy and regulatory support	Financial Instruments
Mini-grids: EEU-led EPC To support social services	Funded by the fiscus, through Government debt. Gender policy	EPC programme funded by the GoE through long term debt.
Mini-grids: Productive use funded by PSE or cooperatives	Public subsidies: Minimum Subsidy Tender (MST) to support deep rural access. Support to the rural economy Sector & trade policy: Tax incentives for import of equipment and components, technology standards	○ Grants ○ Concessional debt ○ A funding platform will leverage economies of scale and scope. ○ Results-Based Financing from Off-grid systems (RBF) through carbon crediting ○ Access to foreign currency ○ Carbon finance - article 6 market mechanism, from CSA and landscape approaches ○ Payment of Tariffs by beneficiaries ○ Political and regulatory risk insurance ○ Carbon finance: article 6 market mechanisms,

		(renewable energy replacing diesel generators, kerosene lamps, inefficient biomass cookstoves). Adoption of a nexus approach including climate smart agriculture interventions and sustainable landscape management approaches will increase the carbon benefit of the program.
SHS and Solar lanterns Focus on latest technology and improved verified quality products	Minimum Subsidy Tender (MST) implementation Results-Based Financing (RBF) to link financing to the quantity and quality of service and support rural areas. Trade policy to remove import bottlenecks, support import substitution and build local manufacturing base	○ World Bank through Ci-Dev has secured access to carbon from CDM PoA with DBE. ○ A Revolving fund - to ensure adequate support to the off-grid technology supply ○ Forex support ○ Credit line at the Development Bank of Ethiopia (Market Development Credit Line)* for retail loans to Ethiopian private sector & wholesale loans to Ethiopian MFIs. ○ Carbon finance: article 6 market mechanisms, adoption of a nexus approach
Productive use appliances	Import duties waived	Micro-finance, concessional loans to agriculture commercialisation clusters (ACCs)

Table 6: Summary of regulatory and funding instruments by off-grid technology. (NEP2.0)

3. Levers for Transformative Climate Action

This section evaluates Ethiopia's enabling environment against a framework of eight catalytic levels developed by the World Bank (World Bank 2020) and makes a set of recommendations that highlights barriers and opportunities that impact the sector across all eight dimensions of the framework. Further analysis is provided in Annex 1.



Figure 4: Eight levers for transformative climate finance. (World Bank 2020).

3.1. Summary Recommendations

3.1.1. Project-Based Financing

1. Affordable debt from local financial institutions would remove the foreign currency risk to project developers. A recent survey amongst African Financial institutions reveals an appetite for off-grid financing particularly if a first-loss cash reserve is available (G4A 2020). Opportunities for local financial institution investment into the off-grid sector in Ethiopia should be explored.
2. A programmatic approach involving a competitive procurement and multiple sites for a limited number of private sector actors will support economies of scale, and allow for the development of a funding platform to lower the cost of debt. Scale will also allow developers to manage risk across a portfolio of sites.
3. Clarity from Government on demand and supply subsidies is required. Implementation of the Minimum Subsidy Tender (MST) mechanism for deep rural areas, requires funding for technical assistance.
4. The more than 3000 potential mini-grid sites need to be consolidated into a phased pipeline of projects once data is collected from the pilot projects currently underway. Site selection should favour financial viability over social gains during early stages of the project in order to build positive momentum.
5. Developers may need further assurance on regulations regarding grid encroachment. The requirement for private developers to implement grid-codes for the distribution networks will add additional cost and may inflate costs of marginal projects making them non-viable. MOWIE have indicated that it will provide financing and implementation of distribution networks for certain sites.
6. Political and regulatory risk insurance across the programme as well as joint ventures with local companies can help to mitigate risks. Conflict is an endemic problem in certain parts of Ethiopia and is a risk multiplier together with climate change. For project developers, effective communication, responsible business conduct, maintaining sustainable and professional operations, and effective community engagement are strategies that have been shown to reduce risks. (World Economic Forum 2015)
7. Availability of innovative financial instruments is needed, particularly concessional debt finance, foreign exchange hedging, guarantees and insurance products. See note in Annex 4 on page 47 relating to new instruments developed by the Climate Finance Lab. To address the challenge of affordable debt finance, the AfDB's has established a debt funding platform: The Facility for Energy Inclusion (FEI). See Annex 4 – Resources.
8. Affordability for households and businesses particularly in rural areas is a challenge. A thriving rural economy depends on support to agriculture to ensure productivity. This report argues that a water energy food nexus approach can play a key role.
9. Project finance transactions are expensive, can be time consuming to conclude and only make sense for larger deal sizes. Opportunities to lower transaction costs should be sought. CrossBoundary have committed to open source documents that will assist with project finance structuring by May 2021. These transaction templates will help to reduce legal costs associated with transactions. They will be made available at <https://www.crossboundary.com/energy-access/open-source/>

3.1.2. Fiscal Policy

10. There are important 'just transition' considerations for Ethiopia as it uses fiscal policy to transition to a middle income country with sustainable development at the core of its development agenda. This is particularly pertinent for the rural poor in areas of the country where endemic unrest is fuelled by food security challenges.

11. Stakeholder engagement in order to strengthen public awareness particularly with regards to the regions will help to build support for fiscal policy measures.

3.1.3. Sector Policy

12. At this stage of the market development, both demand and supply side subsidies will likely be needed in the off-grid space.
13. Technical assistance and capacity development will be needed to support the implementation of the Minimum Subsidy Tender (MST) mechanism combined with Results-Based Financing to incentivise service to deep rural areas.
14. There is a need for or cross-sectoral/ministerial cooperation to support integrated planning across the water-energy-food nexus.
15. Leveraging synergies and linkages between the off-grid programme and existing natural resource management programmes will result in improved outcomes. Leveraging the agriculture extension services network to assist with rollout of the off-grid programme will help to drive an integrated approach. This is aligned with the Nexus approach discussed elsewhere in this document and creates opportunities for the off-grid programme to leverage existing programmes that are embedded in the regions and have delivered value to rural communities.
16. Continued enforcement of technology standards is an important component of the current phase of market development. Efforts should be made to bring informal networks for solar lanterns and related products into the formal economy in order to ensure that quality certification is maintained.
17. Mini-grid licencing procedures and the setting of tariffs have not yet been tested at any sort of scale. It will be important to listen to private sector stakeholders and adjust regulatory processes if bottlenecks emerge.
18. For the private sector time is money. It is important that a capacitated government agency is able to quickly resolve disputes and blockages as they emerge during the market development phase.
19. Lessons from Kenya, Nigeria and particular Bangladesh's experience with IDCOL may provide guidance for Ethiopia.

3.1.4. Trade Policy

20. Additional funding may be needed for the MDCL to support growth of imports of verified products.
21. Policy support to incentivise import substitution and encourage local manufacturing capacity of key components of off-grid technologies will have medium term benefits in terms of job creation and balance of payments.
22. It is important that Ethiopia stays the course on tax incentives at this stage of the market development of the off-grid sector.
23. In parallel, further policy support is needed to reduce trade barriers related to technology components for the off-grid programme.

3.1.5. Innovation

24. Business model innovation will create opportunities in the Ethiopian off-grid sector. This type of innovation requires the ability for the private sector to try new approaches that may fall outside of the existing regulatory framework.
25. MOWIE has highlighted three technology innovations related to the off-grid sector that will have long term benefits for the economy as well as the climate agenda. These are:
 - E-mobility: local manufacture of electric two- and three-wheeler vehicles will reduce the demand for import of fossil fuels which will have a significant benefit on the balance of payments as well as reduce emissions from the transport sector.

- Clean cooking is an important part of the off-grid programme. In particular the adoption of efficient electric cookers will help to reduce the demand on ecosystems for biomass as population pressure grows. (see section 2.2.4 on page 16)
- Innovations around productive use and access to productive use appliances are essential for the rural economy to reap the agriculture productivity dividend that will ensure affordability of the off-grid tariffs. Financing mechanism need to cater for productive use infrastructure as part of the funding package.

3.1.6. Carbon Markets

26. There is an opportunity to adopt a water-energy-food nexus approach alongside the off-grid programme. If done at scale, this has the potential to address climate risks to the rural economy as well as deliver significant carbon benefits. A key outcome is improved productivity by rural farmers which addresses the affordability risk for off-grid developers. Carbon from forest and land use-related projects realised a carbon price three times that of renewable energy in 2019 on the voluntary market due to the significant co-benefits from these type of projects.
27. Look for opportunities to pilot Paris Agreement Article 6 projects.
28. Scaling carbon projects will require additional technical assistance and capacity development to further build out a country-wide MRV system. There are opportunities to leverage cloud technology and digitisation to support the MRV system.

3.1.7. Climate Intelligence & Data

29. Internet connectivity is a development priority and there are compelling reasons to support affordable connectivity for villages and settlements. It will allow weather forecasting information to be broadcast to farmers to assist with short term decision-making related to planting and harvesting. It will also support mobile money payments, education, access to information and connect farmers to markets and supply chains.

4. A Nexus Approach - Water, Energy and Food

“Any strategy that focuses on one part of the water-food-energy nexus without considering its interconnections risks serious unintended consequences.” (World Economic Forum, 2011)

4.1. Recommendations

1. An inter-ministerial working group with representatives from MoWIE and Ministry of Agriculture should be established to address challenges and opportunities that arise from the off-grid programme.
2. Policy formulation related to the water-energy-food nexus needs to be informed by the latest scientific evidence. Any climate change adaptation and mitigation strategy that focuses on a sectoral approach and on one part of the water-energy-food nexus without considering their interconnections and synergies, risks maladaptation consequences.
3. Look for overlaps, linkages and development opportunities with existing landscape and watershed programmes. In particular opportunities to embed climate smart agriculture practices as part of the capacity development programme for the off-grid sector utilising Ethiopia's far-reaching agriculture extension service network, will reap benefits.
4. Cooperation among all decision-makers particularly around investment decisions is critical, particularly as demand for scarce resources continues to grow.
5. The African Risk Capacity (ARC) (www.africanriskcapacity.org) or other risk pooling services can provide insurance pay-outs to smallholder farmers and should be evaluated. ARC is a Specialised Agency of the African Union and includes drought and flood early warning services.
6. A number of studies have demonstrated that integrating gender issues, i.e. women's needs as a key variable in energy and nexus projects makes it more likely that the project will have a substantial impact on household and community poverty reduction and on gender equality. (Soler, Jæger and Lecoqu 2020). Gender mainstreaming should be a key component of capacity enhancement initiatives around the off-grid energy programme.
7. Collaboration on water, energy and food security strategies between all levels of government will help to deliver on the CRGE priorities. In particular, stakeholder engagement should aim to ensure that the abstraction of ground water is monitored and done in a sustainable manner and is supported by aquifer management initiatives.
8. Enable communities with internet connectivity so that they can improve access to markets, receive climate information services including weather forecasts and access knowledge and best practice.
9. Small scale water harvesting and simple irrigation systems can assist smallholders to maintain agriculture productivity in the face of climate variability as part of a package of household support.
10. Reducing human pressure on ecosystems is challenging as the population continues to grow, but it is vital to allow regeneration of landscapes and forests. As part of the off-grid programme, existing cookstove projects need to be scaled up to reduce demand for biomass. Piloting of efficient electric stoves is an important and potentially transformative innovation.
11. Ensure that policy decisions are grounded in the latest scientific literature. In particular, agricultural soil quality is the cornerstone of food and biomass production, for storing, filtering, transforming and recycling water and nutrients, and is the core building block of the water-energy-food nexus. (Hamidov and Helming 2020).

4.2. Background to the Water Energy Food Nexus

Water, energy and food systems are inextricably linked. Water and energy are needed to produce food, energy is needed to pump, transport and treat water, and water is needed for many forms of power generation. The agrifood sector is responsible for almost 80% of total freshwater use, 30% of total energy demand, and 12-30% of anthropogenic greenhouse gas emissions worldwide. As population pressure increases, the agrifood sector is facing unprecedented resource pressure and the risk multiplying effect of climate change adds further uncertainty and resource constraints. Meeting sustainable growth targets requires a holistic approach to understanding the linkages between water, energy and food. Africa is not alone in experiencing nexus resource pressure; all over the developing world, water, energy and food shortages combine to jeopardize livelihoods and exacerbate conflict and political instability.

An effective response that sustains natural resources, addresses human well-being and promotes economic growth requires that nexus issues must be tackled together. Although this approach has not been fully mainstreamed, there are immediate benefits to the rural economy in Ethiopia.

A water-energy-food nexus approach, as opposed to a pure focus on energy, will drive an improved policy response to climate risks by addressing cross-cutting challenges of climate change and will deliver more integrated outcomes. A

nexus approach will address trade-offs and opportunities in the rural economy in a more cohesive and integrated manner, and by supporting improved agriculture productivity in the face of climate change, it will safeguard rural livelihoods and ensure the affordability of off-grid tariffs for the long term benefit of the programme.

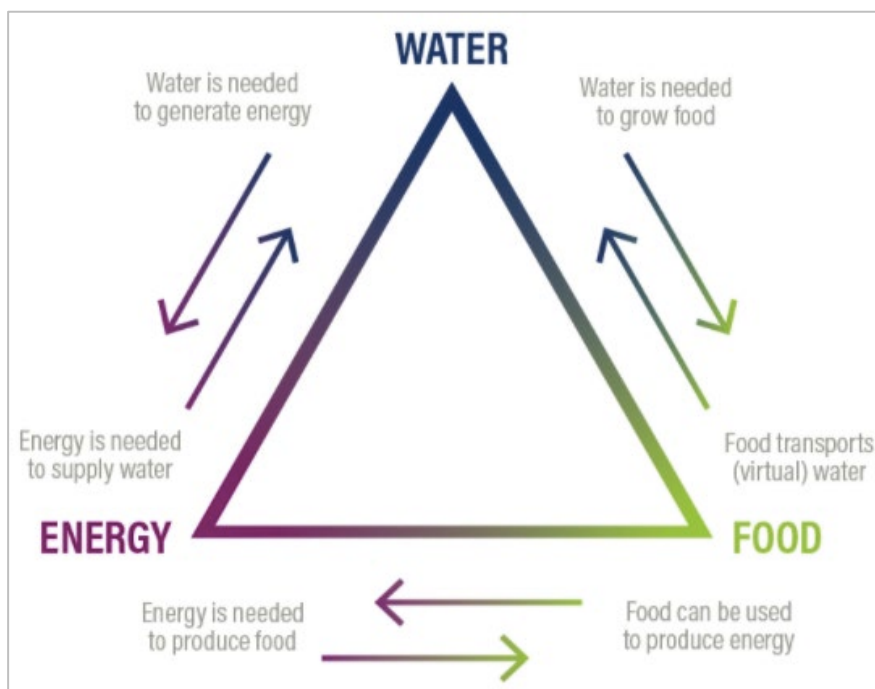


Figure 5: Water, energy and food systems are inextricably linked (WRI 2020)

Although Ethiopia's CRGE initiative follows a sectoral approach, agricultural productivity, renewable energy and access to water for irrigation and drinking are fundamental building blocks that enable the strategy. Addressing these building blocks in a systemic manner by adopting a nexus approach can deliver outcomes that address both adaptation and mitigation indicators in an integrated manner. For example, climate smart agriculture practices have been demonstrated to successfully deliver increased productivity while sequestering carbon in the soil and improving soil health whilst reducing irrigation requirements and the use of energy for pumping groundwater. Solar powered irrigation can reduce the cost of water pumping yet unless climate friendly irrigation practices are adopted, there is a risk of over-abstraction of groundwater.

Importantly, a nexus approach places the sustainable management of landscapes and agriculture as both a key driver as well as essential outcome of the nexus approach. This is of vital importance to Ethiopia where degraded landscapes, largely as a result of unsustainable agriculture practices over many years, are the largest source of greenhouse emissions and also threaten rural livelihoods and ecosystems. In addition, a nexus approach will drive improved mitigation outcomes. In this respect, a focus on landscapes is essential for Ethiopia to meet its NDC mitigation targets and creates the possibility for an enhanced carbon revenue stream if Government decides that they want to monetise the carbon benefit. It is important to note that while a nexus approach will lead to significant benefits, implementation requires cross-ministerial collaboration which can be challenging.

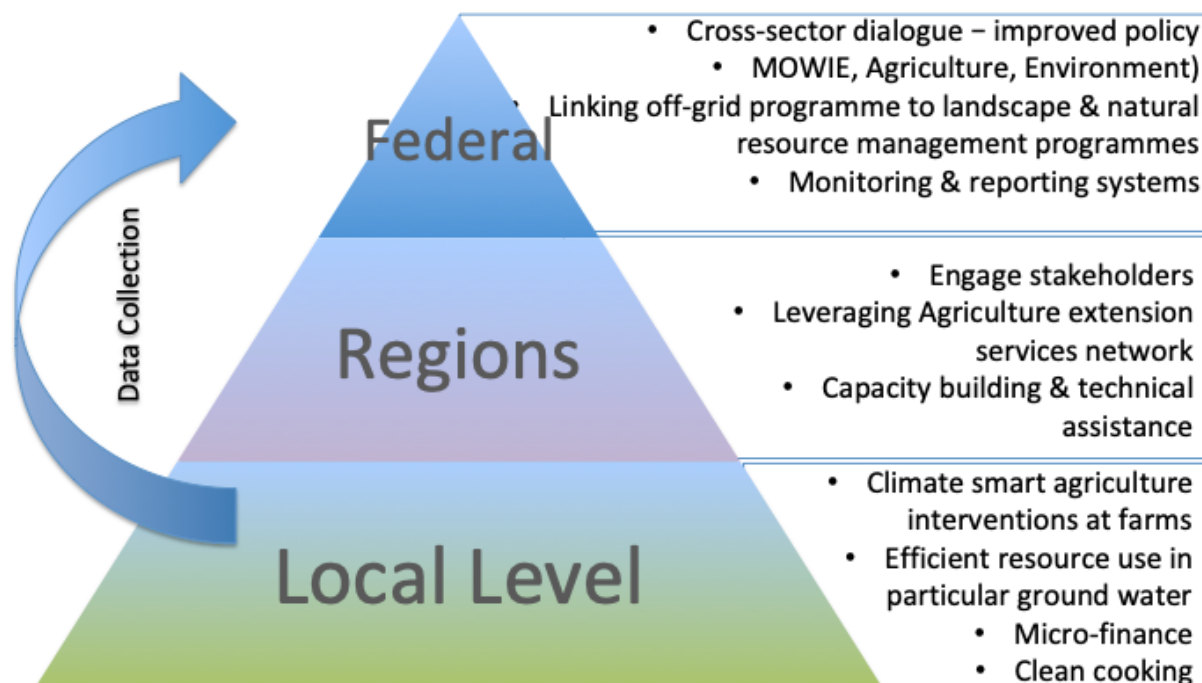


Figure 6: Opportunities for Nexus interventions at each level of government.

The overall goal is to support better decision making at each level of government with the outcome that farmers are supported to manage resources in a sustainable manner, food productivity is maintained and improved and households are able to afford off-grid tariffs.

The agriculture sector is one of the four pillars of the green economy growth strategy as articulated in the CRGE which aims to improve crop and livestock production practices for higher food security and farmer income while reducing emissions. Agriculture has been a major contributor to Ethiopia's impressive growth over the past decade and it will continue to play an outsized role in the country's economy. Yet food insecurity has been an ongoing and persistent problem for the past two centuries. In response the Ethiopian Government launched the productive safety nets programme (PSNP) in 2005, funded by a multi-donor trust, which has been responsible for sustainable land management interventions on approximately 600,000 ha. Whilst PSNP is primarily a climate change adaptation intervention, there are significant mitigation co-benefits. A recent paper published estimates a total reduction in net GHG emissions from PSNP's land management at the national scale of 3.4 million Mg CO₂e per annum (Woolf, Solomon and Lehmann, Land restoration in food security programmes: synergies with climate change mitigation, 2018). This is approximately 1.5% of the emissions reductions in Ethiopia's Nationally Determined Contribution for the Paris Agreement. Currently this carbon benefit is not monetised. The

PSNP offers a tangible demonstration of the multiple benefits that emerge when taking an integrated approach, one that provides many lessons to inform the development and scaling up of similar interventions in the future.

A major constraint to modernising Ethiopia's agriculture sector is the small area of land under irrigation, despite the country's relatively abundant water resources. Overcoming this barrier requires changing farmer's resistance to new practices, access to finance and shortage of electricity in rural areas which the off-grid programme aims to address. An integrated or nexus approach addresses this challenge in a systemic manner that ensures optimum outcomes.

Soil salinisation in Ethiopia is a major contributor to land degradation

Salinization is one of the causes of a loss of soil fertility. It is a build-up of salts in the soil, and is one of the most devastating environmental problems affecting arid and semiarid regions of the world, where there are higher evapotranspiration rates in relation to precipitation. It is a major contributor to land degradation, decreases in soil fertility and desertification.

Soils, especially in dry areas, are often naturally salty, but inefficient irrigation and poor drainage lead to waterlogging, which raises the water table, bringing salts in the subsoil nearer the surface. When the water evaporates, salt is left around the roots of plants, preventing them from absorbing water, stunting growth and contaminating drinking water supplies. About 44 million ha (36% of the total land area) is potentially susceptible to salinity problems of which 11 million ha have already been affected by different levels of salinity and mainly concentrated in the Rift valley.

In Ethiopia, the naturally salt-affected areas are normally found in the arid and semiarid lowlands and in Rift valley areas that are characterized by higher evapotranspiration rates in relation to precipitation. (Hamidov and Helming 2020). This case study illustrates the importance of policy decisions being grounded in the latest science to prevent maladaptive outcomes.

5. An Endowment Fund for the Off-Grid Sector

5.1. Summary and Recommendations

1. An Endowment for the Off-Grid Sector would offer investors and asset managers the ability to diversify their portfolios and at low risk, invest in vetted projects with significant climate change and socio-economic co-benefits aligned with the SDGs.
2. This instrument has wide potential application in sub-Saharan Africa and emerging examples support this approach. This should be seen in the context of building momentum for a new source of private sector finance.
3. A professional management structure with transparent governance coupled with an efficient off-shore tax structure with no risk of political interference or threat to the capital in the fund would provide the type of security needed to build a significant endowment and has the potential to attract North American and European investors to the table.
4. Ethiopian Government representation at board level would ensure that the endowment supports projects that are aligned with the country's development policies and climate agenda.
5. The endowment could operate alongside and complementary with the CRGE Facility to leverage additional capital.
6. The fund would primarily provide concessional debt for project developers and could provide a first-loss cash reserve to leverage debt from local financial institutions (Greenmax 2020). A small percentage of the fund might be allocated to grants for the development of early-stage projects, feasibility studies, technical assistance and capacity development to support climate smart agriculture and nexus interventions.
7. An endowment would take 24 – 36 months to establish and likely cost on the region of USD \$500,000 - \$ 700,000 to establish. Donor finance is needed to support the fund design and implementation.

5.2. What is an Endowment?

This report recommends investigating the establishment of an off-grid energy endowment fund for Ethiopia. An endowment has the potential to address the off-grid funding shortfall and, in return, deliver impact as well as capital preservation to investors.

As the divestment from fossil fuels gathers pace driven by the compounding costs of climate change, the largest asset managers on the planet with trillions under management are looking to diversify their portfolios and achieve impact in order to address emerging climate risks. A recent example is the world's largest money manager BlackRock, which has committed to making climate change the core of its investing strategy (CNBC 2020).

Endowment Funds are financial instruments that have been used for many years, most notably in the education sector to fund universities. More recently endowments have emerged as funding instruments for environmental and climate change projects. A recent example in sub-Saharan Africa is the endowment fund set up to support sustainable development in the Cubango-Okavango River Basin (CORB). CORB holds one of the world's most unique, free-flowing rivers, and supports a rich and unique biodiversity that makes it a wetland of international importance and World Heritage site. The endowment will support the climate resilient livelihoods enhancement, enhancing ecotourism, and joint infrastructure development (CIWA 2017).

A more ambitious endowment fund was established in Germany in 2019 by a group of international investors and entrepreneurs in response to the climate crisis. The aim of the Climate Endowment⁷ is to provide a platform for institutional investors to allocate more of their huge capital stock to renewable energy, new mobility and related clean-tech assets. The funders of Climate Endowment plan to obtain commitments from the public and private sector to achieve a size comparable to the large U.S. endowments with approximately €20 billion–€40 billion (\$23 billion–\$45 billion) of assets under management. It aims to provide an attractive solution for EU pension funds and insurance companies to invest in clean energy companies and other companies that have significant climate mitigation potential.

5.2.1. Factors that Support an Endowment Structure to Finance Renewable Energy in SSA.

- Due to underdeveloped capital markets, fund managers wanting to diversify portfolios and invest in African infrastructure are unable to invest in liquid stocks and bonds of infrastructure companies, municipalities or projects in public exchanges because they largely don't exist. The demand for infrastructure financing in SSA is mostly in debt and equity directly into greenfield projects which may present significant construction risks. Developing a robust African investment portfolio requires patience and local knowledge which is beyond the scope of most fund managers in North America and Europe. Large asset managers usually have small teams with limited bandwidth attempting to place large amounts of capital. This means that they are unable to perform the necessary due diligence to fund a basket of relatively small African projects. An endowment fund focusing on the off-grid sector in Ethiopia could partially address this constraint by providing a linking role between asset managers and projects on the ground.
- Contrary to what many believe, the default rate of African investment projects is lower than similar debt in many developed market regions (for example, North America) and a significantly lower default rate than many other emerging market regions such as Latin America and the Caribbean (Moody's Investors Service 2018). In addition African infrastructure projects often benefit from various risk controls such as currency risk hedging and risk mitigation instruments provided by DFI's.
- Infrastructure investments are often positioned as inflation hedge investments in an asset manager's portfolio. The proposed endowment fund will provide exactly such a capital preservation outcome.
- As discussed earlier, asset managers are increasingly concerned about climate change and sustainable development. Investment in renewable energy projects in sub-Saharan Africa would provide alignment with the Paris Agreement and the SDGs and will also provide the type of socio-economic impact that fund managers are looking for in line with emerging ESG good practices.
- The envisaged endowment fund would address important financing gaps which currently constrain African infrastructure viz early stage project financing and concessional debt at longer tenor commitments. By addressing these significant gaps, it is likely that this fund could leverage significant additional private capital.

An Endowment for the Off-Grid Sector would offer investors the following:

- Ability for asset managers to diversify their portfolios and at relatively low risk, invest fund returns in a basket of high impact projects in sub-Saharan Africa. The low risk is provided by the capital preservation mandate of the endowment.

⁷ <https://climate-endowment.com/>

- Investment of fund proceeds in vetted projects with significant climate change and socio-economic co-benefits aligned with the SDGs.
- A professional management structure with transparent governance.
- An efficient off-shore tax structure with no risk of political interference or threat to the capital in the fund.
- Capital preservation in order to keep pace with inflation.
- The ability to withdraw preserved capital according to notice periods determined by agreements with funders.

Benefits of an Endowment Fund

- Provides a risk-free platform for North American and European fund managers to invest in SDG-aligned projects in the region.
- The ability to support the growth of the off-grid sector and address funding gaps in order to achieve universal electrification targets by offering grants, concessional debt, and working capital loans for equipment businesses.
- The ability to leverage additional capital.
- An independent governance structure that would oversee investment in projects in the sector aligned with Ethiopia's development policies and climate agenda.
- Provide a model for a new type of instrument to address energy access.
- It could provide a first-loss reserve to address risks to local currency financing outlined by African Financial Institutions (Greenmax 2020).

5.2.2. Starting assumptions: Size of the Fund

What capital amount is reasonable to target? Our modelling has assumed a fund starting at \$400M in size with the capital amount growing at 10% per annum for 10 years by attracting new capital into the fund.

This is an ambitious target however the stakes are high and bold financing action is needed. As climate breakdown continues to impact economies around the world, governments and the private sector are starting to get a clearer view of the future costs and risks. As a result, global fund managers, responsible for trillions of USD under management, are embracing the SDGs and the Paris Agreement in order to achieve social and environmental impact to address future systemic risks. As part of this global reallocation of capital, fund managers are moving away from investment in fossil fuels and looking for suitable projects across the developed and developing world that deliver both impact and returns. In his 2021 letter to CEOs, the chief executive of Blackrock, the largest fund manager in the world, committed Blackrock on a path to placing sustainability and climate change at the center of their investment approach.

However a common theme emerges in discussions with leading fund managers: There is a shortage of suitable investment projects and opportunities at the scale needed particularly in sub-Saharan Africa. As discussed earlier, Africa's underdeveloped capital markets mean that fund managers cannot easily invest in liquid stocks and bonds. Instead they are required to perform extensive due diligence in order to invest directly through debt or equity in projects. This barrier to entry prevents funds flowing to where they are needed yet there is a pressing need for ambition in scale and scope. With this in mind, and taking into consideration the costs of establishment, our modelling has assumed a fund starting at \$400M in size with the capital amount growing at 10% per annum for 10 years by attracting new capital into the fund.

5.2.3. Investment of Capital

The capital amount should be invested with an established fund manager that specialises in managing endowment funds, and is able to provide a smoothed return with a target of 6% per annum. The fund mandate will include a comprehensive set of environmental, social and governance criteria with climate change a key reporting requirement. Our high level model assumes a nominal return of 6% pa with a real return of 4%. When benchmarked against various 'climate endowments', this is an achievable goal. Climate Endowment, discussed earlier which was funded in 2019 in Berlin notes that over the past decades, large US endowments have returned approx. 12% per annum on average versus approx. 6% per annum for EU pension funds or insurance companies which have a similar risk profile. The investment policy, asset allocation, spending policy and performance monitoring will be determined during the design of the fund.

Supporting the conservative but achievable consistent growth forecast, it is important to note that in March 2020, when global markets sold off due to systemic risks associated with the COVID-19 pandemic, ESG funds' outperformed more traditional funds largely due to their low exposure to oil and gas which gave them an edge at a time when energy stocks suffered steep losses. All indications are that the 'reset' following the pandemic will favour ESG funds going forward. In conversations with stakeholders, a gross return of 6% per annum is a conservative figure which will allow capital preservation and 4% real return allocated for off-grid project investment notwithstanding that some climate endowment fund managers publicise a real (after inflation) return of over 4%.

5.2.4. Leverage Factor

Leveraging additional funds will become easier as the endowment demonstrates that it is achieving its stated intentions and has an effective management and transparent governance structure. For the purpose of the model we assume that the fund leverage 1x return in year 2, growing at 0.5x per until year 10 when it reaches a 5x leverage. It is important to note that if the endowment fund is used in a formal blended structure with commercial debt, there is an inverse proportion between leverage and blended concessionality. This is illustrated in Table 12 in Annex 6.

5.2.5. Management Costs

We have assumed a flat fee of 10% per annum to support the internal operations of the fund. The fund will need to balance how extensively it engages with the project value chain. It may make sense to outsource marketing, project selection and due diligence activities to a third party organisation that operates in the renewable energy space in East Africa. These details will be addressed as part of the fund concept design.

The Fund Team

The executive office will have a small team led by a dynamic managing partner who will be responsible for day to day operations. The managing partner is a key hire and the success of the fund will depend on the managing partner's ability to execute the strategy. He/she will be supported by a team of analysts with background in climate change, development and finance. A small administration team will be required to support the fund team. In the post COVID era the office could be a virtual office however it would be important for members of the team to be based in-country.

Board of Directors: apart from the executive director, the board will be comprised of independent directors and should include a senior representative from the Ethiopian Government.

- Fund raising capacity will be outsourced to a specialist company or individual that has established relationships into North American and European asset managers.
- Investment of the endowment capital will be outsourced to a team that specialises in managing this type of investment.

5.2.6. Investment of Proceeds

The investment of proceeds is what gives the fund its purpose and will depend on a clear investment mandate documented during the design of the fund. A key part of the investment mandate will be the development of an impact evaluation framework.

Discretionary and Non-Discretionary Components of the Fund.

A small portion of the funds (+/- 10%) are discretionary funds that can be deployed fairly rapidly.

The larger portion of the fund (90% +) will be invested based on decisions taken by the investment committee which will meet on a quarterly basis and will operate in accordance with the investment mandate of the fund.

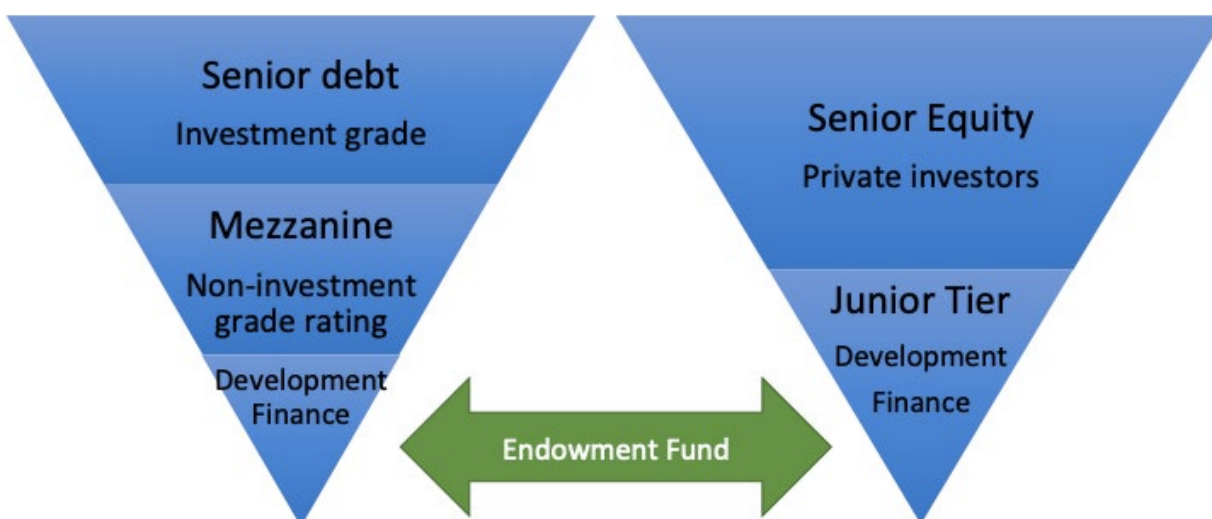


Figure 7: Investment proceeds from the endowment fund can play the role of development finance in a blended finance structure. The asymmetrical risk-return profile for development funds and commercial funds allows a blended vehicle to raise debt & equity from different investors.

5.2.7. Use of Investment Funds

During the design phase, the use of investment funds will be evaluated and analysed in detail after engaging with stakeholders. The investment opportunities highlighted below are for discussion purposes in order to build on the endowment concept.

Earlier in this report, funding gaps that constrain African infrastructure development were discussed. Three immediate funding constraints are described both in the literature and in discussions with project developers viz. (i) reasonably price debt hedged against foreign change fluctuations; (ii) grant funding support for early stage project development in order to build project pipelines; and (iii) working capital for companies importing equipment to supply the Ethiopian market including solar lanterns, solar home systems and productive use equipment. Table 3 below proposes a breakdown of fund allocation.

Instrument	Percentage of fund	Deployed for:
Concessional Debt	80% of funds	Concessional debt for project developers Concessional debt to ACCs to purchase irrigation equipment and other productive use appliances
Grants	15% of funds	Matching grants Early stage project development Feasibility studies Technical assistance Capacity building e.g. to support climate smart agriculture and other WEF nexus interventions. Internet connectivity
Working Capital Loans	5% of funds	Working capital for day-to-day trading operations for solar equipment and productive use importers and distributors. Working capital loans for Internet connectivity businesses at ACCs.

Table 7: Investment mandate breakdown of financial instruments to be deployed

Concessional Debt

Most stakeholders view access to long-term affordable debt as key to the growth of the sector. Certainly a large proportion of the off-grid funding gap in Ethiopia, is the need for affordable loan finance. The majority of the proceeds from the endowment fund should be used in a blended finance structure to support concessional loans for project developers either as a standalone funding source or as part of a broader funding platform. Annex 6 on page 52 provides a modelled overview of the fund.

A significant challenge is that loans in a hard currency create a foreign exchange risk when coupled with revenues in a local currency. Unhedged currency risk is largely unmanageable for the private sector and hedging costs need to be built into the cost of the financing. In Annex 5 instruments from the Climate Finance Lab are listed including a new foreign exchange hedging facility that should be evaluated in terms of its suitability for Ethiopia. An alternative approach which needs further investigation, is the use of local currency financing through the development of local capital markets. A recent research report indicates that African financial institutions would consider investing in energy access projects particular if there was a first loss facility (Greenmax 2020). This is an important area for further analysis during the design of the fund but on the face of it, the fund could fulfil this function.

Increasingly funding platforms are described as an approach to overcome funding challenges for energy infrastructure. In this regard, Winch Energy has recently completed the funding for solar mini-grid projects in 49 villages across Uganda and Sierra Leone through the creation of a new funding platform. (ReNews 2021)

Grant Funding

Grant funding needs to be used where it can have maximum impact and can leverage matching grants from other sources. Much has been written about the use of grant funding to support early stage project development and de-risking activities through technical assistance. Grant funding should also be used to support capacity development activities aligned with water-energy-food nexus interventions at the local level will build community resilience and protect incomes. We also believe that there is merit in supporting small businesses to provide internet connectivity at agriculture clusters.

Foreign Exchange and Working Capital Loans

Micro financial institutions (MFIs) and private sector enterprises (PSEs) have been key players in the provision of solar lighting and charging products and solar home systems. (Government of Ethiopia 2019) The Market Development Credit Line (MDCL) managed by the Development Bank of Ethiopia serving as a financial intermediary for funding provided by the World Bank, is a financing agreement between the IDA and the GoE to support private sector companies to supply renewable energy products. It has provided credit to private sector companies that have delivered over 70,000 solar home systems and 1.1 million Lighting Global certified solar lanterns to Ethiopian households.

Ethiopian companies are required to import solar equipment that meets quality standards from international manufacturers because there is limited local manufacturing and assembly. The Market Development Credit Line (MDCL) is a financing agreement between the IDA and the GoE to support private sector companies. The credit line provides retail loans to private sector companies who import solar equipment, and wholesale loans to microfinance institutions (MFIs) to enable their clients to purchase equipment.

During fund design, it will be important to engage with the GoE to understand requirements to supplement the MDCL by providing short term working capital loans to equipment importers and suppliers.

5.2.8. Establishing the Fund

Establishing the fund is likely to cost in the region of USD \$500,000 - \$700,000 and will take at least 36 months to design, implement, fund raise and operationalise.

Fund Establishment Phases and Timeline

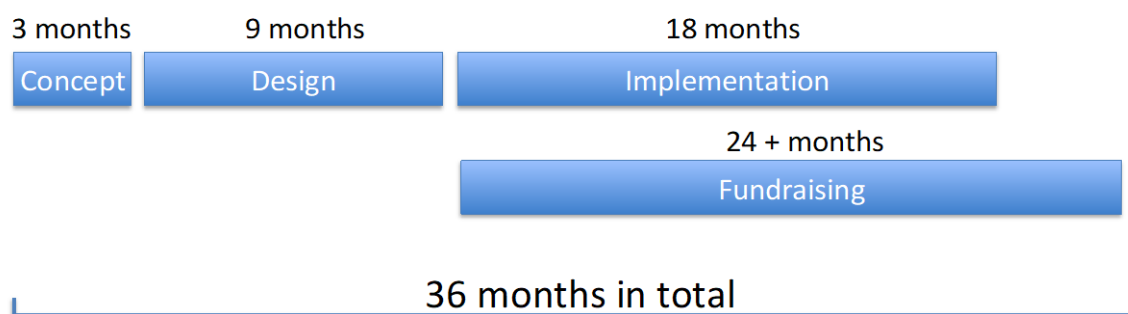


Figure 8: Establishing an endowment will take about 36 months and will cost in the region of USD \$ 500,000.

There are three distinct phases of fund establishment: the concept and design phases are likely to take 12 months with the implementation phase taking a further 18 months. Once the fund has been designed, fund raising can start and this is likely to take at least a further 24 months. An experienced fundraiser with relationships and networks into the large asset managers in Europe and North America will need to be appointed.

Key to the success of the fund's ability to attract investors will be its independence from political interference. The fund should be domiciled off-shore and will need an experienced and credible international legal firm to establish it. In terms of fundraising activities, feeder accounts from North America and Europe will channel investor's funds into the main fund account.

5.2.9. Summary of the Fund

Criteria	Details
Assets under management	\$400 M in year one, growing at 10% per annum
Targeted returns on average per annum	6% gross 2% of returns offset inflation of capital amount giving a net return of 4%
Net Present Value of cumulative net returns Discount rate of 2% (USD inflation)	USD \$225M
Funds Leveraged Leverage factor: 1x in year increasing to 5x in year 10	USD \$682M
Aggregate NPV of cumulative net returns and leveraged funds	USD \$ 900 M
Management costs	10% of net returns
Lifetime of fund	Perpetuity

Table 8: Summary of Endowment fund financial indicators.

6. The Role of Carbon and Climate Finance

The funding approach outlined in this report does not preclude the use of climate and carbon finance. Multiple approaches and sources of funding are required and carbon and climate finance are important parts of the funding mix.

In terms of climate finance, the scale of the required investment across the developing world is huge with demand far outstripping the supply. The process of securing climate finance requires a long lead time and because it is a highly competitive process, success is never guaranteed. The authors are aware of applications to the Green Climate Fund (GCF) to fund elements of the off-grid programme and these complementary initiatives are to be encouraged and will help to address the funding gap if they are successful. Specific project proposals supporting the implementation of the off-grid program could utilise funds from the blended finance platform as co-financing to support a compelling proposal for climate finance from the likes of the GCF.

In spite of significant traction in Asia and Latin America, the Clean Development Mechanism has had limited success in Africa. Even post reform, CDM has not provided the transformative change in climate finance that is needed. Projects have struggled to deliver the expected carbon benefits and revenue, likely due to capacity gaps in implementation. Carbon revenues function best as a results-based funding component and in that respect, are complementary with the endowment fund approach proposed in this report. Important pieces of Ethiopia's CDM pipeline are two Programme of Activities (PoAs) at the Development Bank of Ethiopia (DBE). As part of this programme, the Carbon Initiative for Development (Ci-Dev) is purchasing emissions reductions to fund after sales service including battery replacement, warranty tracking and other operations and maintenance costs.

There is an opportunity to pilot a water-energy-food nexus approach in Ethiopia which, if done at scale, has the potential to address climate risks to the rural economy as well as deliver a significant carbon benefit. Encouraging landscape project case studies are emerging in SSA. A current example is the Kariba REDD Project in Zimbabwe established by consulting firm, Southpole.com, which is one of the largest registered REDD+ projects worldwide. These projects are complex to implement and manage but due to the high impact, carbon benefits attract a premium on the voluntary market. The GCF funded 'Sustainable Landscapes in Eastern Madagascar' is an interesting nexus case study that provides useful lessons for Ethiopia. It engages both public and private sector actors for creating an enabling environment to crowd in both international investment and domestic private sector resources by removing investment barriers, and introducing tax incentives for renewable energy and support for PPPs and of direct relevant to Ethiopia's off-grid programme, it combines actions in both agriculture and energy sectors and has the potential to mobilize large scale private investment.

Moving forward the final details for the Article 6 rulebook have been moved to COP 26 in Glasgow. Under the Paris Agreement, emission reductions are national assets and the GoE will need to evaluate whether to trade emissions reductions or have them account towards their domestic NDC targets. If the Government decides to sell carbon, and the country's NDC indicates that it is interested in emissions trading as a seller of credits, the proceeds can contribute to the funding of the off-grid sector. There are a number of approaches that have been undertaken by recent projects regarded as Article 6 pilots and there are a number of diversified contractual structures for internationally transferred mitigation outcomes (ITMO) that have emerged. Importantly all pilots look to avoid double counting of mitigation outcomes and often seek to enhance the current ambition of NDCs. (Sandra Greiner 2019).

Ethiopia will need to significantly reduce emissions from the AFOLU sector in order to meet its NDC mitigation targets. This is a big challenge that will require scaling of current landscape management programmes and adoption of a nexus approach including widespread climate smart agriculture interventions. Carbon finance can play an important supporting role by helping to make marginal projects viable. However there are a number of uncertainties related to carbon finance that will need to be addressed. These include (i) how the ambitious emissions targets contained in Ethiopia's NDC influence the sale of credits, (ii) lack of an operational countrywide MRV system, (iii) current lack of clarity around the rules of Article 6, (iv) experiences with current CDM projects that have underdelivered in terms of carbon benefit, (v) uncertainty about whether Government will trade ITMOs (vi) and the fact that the carbon market at current prices is depressed.

Source: World Bank 2016b

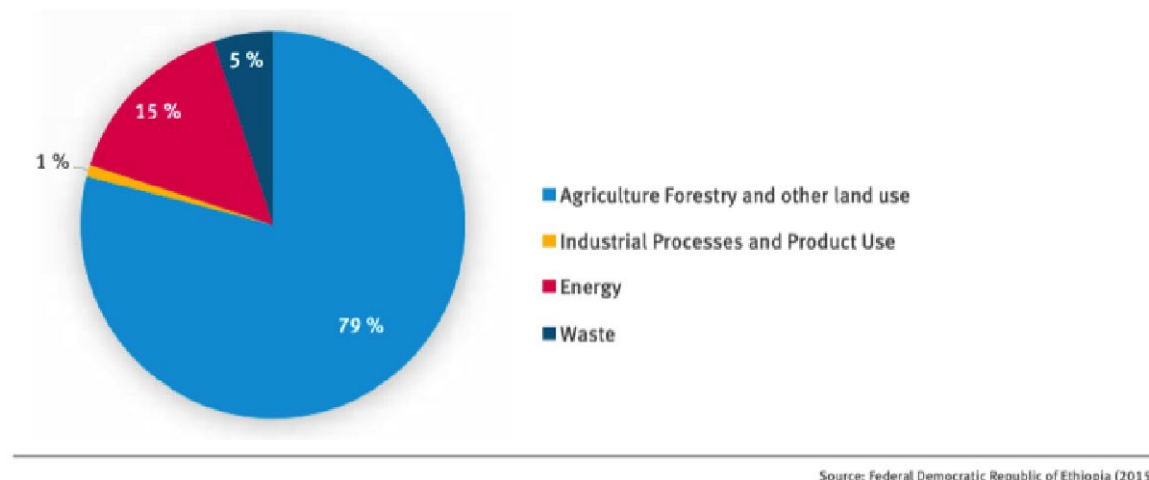


Figure 9: The majority of emissions in Ethiopia are from the AFOLU sector. Further scaling up of sustainable landscape projects will be required in order to meet NDC mitigation targets.

Growth Potential in Carbon Markets

Aside from Article 6 negotiations which will provide clarity around the future of the carbon markets under the UNFCCC, there are a number of indications that the voluntary carbon market is set to undergo significant growth which bodes well for the future price of carbon. Mark Carney, UN Special Envoy for Climate Action is leading a task force on scaling the voluntary market. The taskforce estimates that, although noticeably short of what is needed to support net-zero, demand in the voluntary carbon markets is growing at 34% per annum, and reached 71MtCO₂e in 2019. (Farand 2020)

There are a number of recent factors that are driving the increase in demand:

- In 2016 airlines adopted a regulatory framework to address carbon emissions called CORSIA or Carbon Offsetting and Reduction Scheme for International Aviation. This, alongside some airlines setting more aggressive reduction targets, is expected to sharply increase the volume of airline buyers in the voluntary carbon market, where supply currently outstrips demand.
- Companies, including banks and investors, under pressure to go net-zero, are also predicted to start boosting demand.
- Country-level pledges, such as China's carbon neutral target, will need carbon offsets, also affecting the market.

- As mentioned above, the recent launch of a private-sector-led initiative working to scale an effective and efficient voluntary carbon market to help meet the goals of the Paris Agreement, called the Taskforce on Scaling Voluntary Carbon Markets lead by Mark Carney.
- Demand is driven in the voluntary market by companies and individuals taking responsibility for offsetting their own emissions.
- Ecosystem Marketplace's annual survey revealed that renewable energy-based activities represent the highest volume of offset transactions, according to the survey. But forest and land use-related offsets, the second highest volume of transactions, garnered a price three times that of renewable energy in 2019 (average price of \$4.3 per tonne compared with \$1.4 per tonne) because of socio-economic and environmental co-benefits.

Carbon Markets Summary - Barriers and Opportunities

- Is the voluntary or the compliance market more suitable for Ethiopia? Carbon from forest and land use-related projects realised a carbon price three times that of renewable energy in 2019 on the voluntary market due to the significant co-benefits from these type of projects.
- Ethiopia's NDC states that it is interested in emissions trading as a seller of credits. However the mitigation targets contained in the NDC are ambitious and rules on double counting preclude sold internationally transferred mitigation outcomes (ITMOs) counting towards country NDC targets. Under the Paris Agreement, emission reductions are national assets and the GoE will need to evaluate whether to trade ITMOs or have them account towards their domestic NDC targets. If the Government decides to sell ITMOs, the proceeds can contribute to the funding of the off-grid sector. There are a number of approaches that have been undertaken by recent Article 6 pilots and there are a number of diversified contractual structures for ITMO transfer agreements that have emerged.
- Carbon revenue from the CDM PoA registered with the Development Bank of Ethiopia in 2016 have not delivered significant carbon revenue. Anecdotally this is due to capacity gaps in implementation as well as monitoring and evaluation processes and this highlights future challenges for carbon markets in the country.
- There is an opportunity to adopt a water-energy-food nexus approach alongside the off-grid programme. If done at scale, this has the potential to address climate risks to the rural economy as well as deliver significant carbon benefits. A key outcome is improved productivity by rural farmers which addresses the affordability risk for off-grid developers.
- MRV remains a significant challenge in the development of carbon markets in SSA. Current MRV systems are not yet operational and this will require significant input but creates the opportunity for an innovative digitisation project using remote sensing to assess landscape carbon stocks.

7. Annex 1: Levers for Transformational Climate Finance

A recent report by the World Bank outlines a methodology that uses eight catalytic levers to evaluate the potential for transformational climate finance (World Bank 2020). Each of these levers are associated with barriers that impede finance flows and, not surprisingly, the majority of the levers relate to policy reform or interventions. It is useful to apply this methodology to the Ethiopian off-grid sector in order to understand how the levers, barriers and associated trade-offs can influence climate finance flows to the off-grid.

7.1.1. Project-Based Financing

Energy access delivered by the off-grid programme will be provided by solar home systems and mini-grids to supply about six million households. NEP 2.0 describes 285 mini-grid sites prioritised by government for mini-grid development with more than half of these situated greater than 100km from existing MV voltage lines. NEP 2.0 also mentions 300,000 connections in deep rural areas without going in to further detail. As mentioned earlier in the report, further geo-spatial analysis combined with Agriculture Commercialisation Cluster (ACC) data indicate that there is scope for a much larger mini-grid programme at agriculture clusters, with irrigation and processing being the key use cases, if private sector support can be secured. In addition there are more than 45,000 hospitals, schools and clinics that are struggling to provide services because they are without access to reliable electricity supply. The mini-grids program will feature public and private actors, public-private partnerships (PPP) as well as cooperative models. A project-funding platform can potentially lower the cost of debt across the programme and early implementation phases should prioritize financial viability.

7.1.2. Green Financial Sector Reform

Green financial sector reform focuses on regulations and policies that encourage investment in low carbon climate resilient development as well as reporting and transparency of financial sector climate risks. This requires both management of climate risks to the economy and positioning the financial sector to take advantage of projects that drive climate action. Ethiopia's 'green' development agenda is contained in the CGRE and GTP II and the country's sustainable growth path provides leadership for other regional developing economies. The aim is for inclusive green growth i.e ensuring that environmental sustainability does not come at the expense of social programmes.

Following the economic turmoil and recession brought on by the COVID pandemic, Ethiopia, like many countries has assembled a stimulus package of approximately USD \$1.2 Bn to support tax relief, assist small business and provide additional liquidity to the Commercial Bank of Ethiopia. The pandemic has put fiscal pressure on African countries to roll back green incentive programmes and tax relief programmes due to short term budgetary constraints and it is important that the country stays the course, in order to attract climate finance going forward. In addition, financial sector reform is often complex and requires capacity building support to drive through the necessary legislative changes.

Barriers and Opportunities

1. The post COVID recovery adds to the urgency for financial sector reform and infrastructure will be a key enabler of the recovery. In that respect the off-grid sector has an important role to play.
2. Ethiopia has made significant progress at a national level and it is important that a shared vision is built with the regions regarding 'green growth' priorities.
3. Experience from Asia suggests that both return-enhancing and risk-reducing instruments are needed, as they work in tandem to make investment more appealing to the private sector. (The Global Green Growth Institute 2018). Policy interventions that contributed to green growth in Asia

include: (i) Strengthening project identification and development (ii) Linking project pipelines to national and sectoral planning frameworks to provide policy certainty to the private sector (iii) Strengthening financial intermediation and credit enhancement practices (iv) Extensive capacity building for private and public sector stakeholders.

7.1.3. Fiscal Policies

In terms of planning towards the goal of carbon neutrality, and specifically for the off-grid programme, a shadow price of carbon can help to cost carbon externalities. In its evaluation of the carbon benefit of the off-grid sector, NEP 2.0 has used the World Bank shadow price of carbon at \$67 per ton and models the value of the carbon saving from the off-grid sector which rises to \$260M per year by 2025. This significantly overstates the current commercial value of the carbon but provides a methodology for Government to account for carbon externalities when undertaking an economic analysis of the off-grid programme (World Bank 2017) and provides a indication of the significant global climate change benefit of the off-grid programme.

A study on the implications of a carbon tax for Ethiopia modelled a starting tax of USD \$5 per ton increasing to \$30 per ton by 2030, and concluded that while the tax would have little impact on overall economic activity because petroleum fuels and kerosene are a relatively small part of the Ethiopian economy, the tax would raise up to \$800 per year by 2030 and would send a strong pricing signal to the market. (Telaye, et al. 2019). The paper examines the impact of a carbon tax on the poor and examines scenarios where the carbon tax is offset by more targeted pre-poor tax regimes.

7.1.4. Sector Policies

It is widely recognised that both supply and demand side subsidies are an essential tool for countries to reach universal access. This is certainly true in Ethiopia where tariffs are some of the lowest in sub-Saharan Africa and the Government is keen to maintain a uniform national tariff across both the on-grid and off-grid sectors. The subsidised national tariff creates challenges for project developers attempting to build viable business models for off-grid projects. At this stage of the market development, both demand and supply side subsidies are likely to be needed in the off-grid space. MOWIE have expressed their support for higher tariffs for commercial mini-grid off-takers where in effect the commercial customer subsidies households and are also committed to providing capital subsidies to projects that require them to reach financial viability.

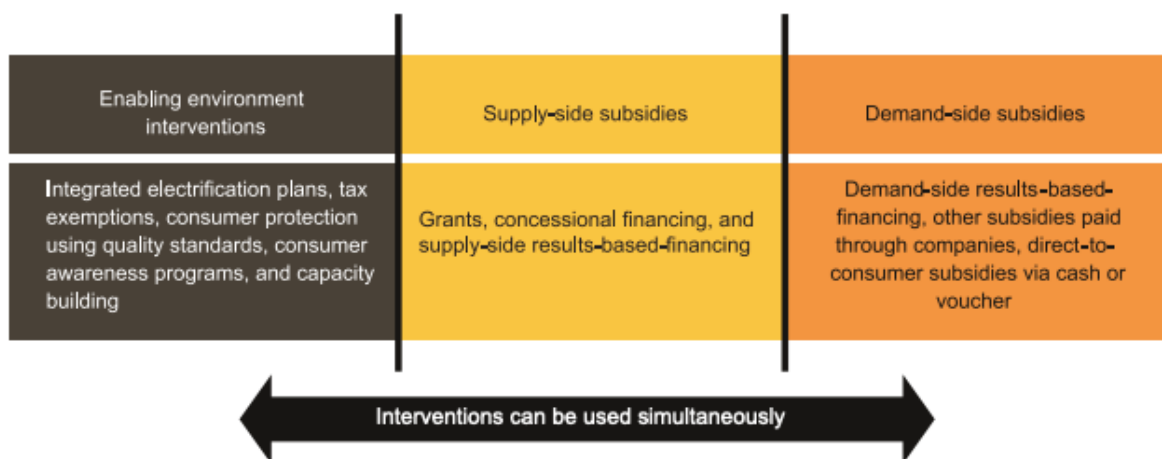


Figure 10: Off-grid market development toolkit (Africa Clean Energy Technical Assistance Facility 2020)

Quality standards are important during a market development phase to ensure that products perform as advertised and to prevent customer dissatisfaction. In 2018 the GoE with support from Lighting Global established a Pre-Export Verification of Conformity (PVoC) procedure for all pico-solar imports into Ethiopia with the intention of removing delays in the export process. PVoC, which was implemented to address private sector concerns about delays, is an inspection and verification procedure applied to a specific set of goods entering a country where goods are inspected prior to being shipped to ensure compliance with local standards.

Mini-grid licencing procedures and the setting of tariffs, both functions of the EEA, have not yet been tested by private sector investors at any sort of scale.

In summary the sector enabling environment has significantly improved with the intention to encourage private sector investment. Government should continue to listen to concerns shared by private investors as the programme rolls out. Capacity gaps within key agencies such as EEA are likely to warrant further support, particularly as regards licencing procedures for foreign project developers.

Case Study – IDCOL, Bangladesh

Bangladesh's off-grid programme is regarded as one of the most successful in the world largely due to the effectiveness of IDCOL, which is a public private partnership special purpose vehicle managed by an independent board of directors, and established to finance infrastructure projects. IDCOL receives funding from multiple sources including the Government of Bangladesh, and multi-lateral donor agencies. High population density, established micro-finance players and an ecosystem of partners have contributed to IDCOL's success. Partners, selected through a competitive process, receive grants and concessional loans, and technical assistance and in return provide loans to customers which enables to afford solar home systems. The IDCOL model cannot be replicated for Ethiopia but there are a few key lessons that can be adapted to the local context: (i) the need for an effective and well-managed independent organization like IDCOL with credibility amongst donor and partners and (ii) an effective partner ecosystem with rural reach and (iii) a debt facility that should provide a financial incentive for partners to make sales and service customers. (Africa Clean Energy 2020)

7.1.5. Innovation - Barriers and Opportunities

Innovation requires a supportive ecosystem and different countries are generally different stages when it comes to supporting the innovation value chain.

1. As discussed in NEP 2.0, a digital payment system which will reduce the costs associated with the logistics of cash payments, together with an integrated supply chain, will help to drive liquidity into the off-grid sector and reduce working capital requirements of actors in the supply chain.
2. Business model innovation will create opportunities in the Ethiopian off-grid sector. This type of innovation requires the ability for the private sector to try new approaches that may fall outside of the existing regulatory framework.
3. Look for technology transfer opportunities to embed innovations from other regions and countries. Kenya is an interesting case study for Ethiopia. Market growth in Kenya has been enabled by the widespread use of microfinance, mobile phones, and adoption of mobile money, which plays a key role pay-as-you-go business models. (NEP 2.0)

7.1.6.E-mobility

Africa fits many of the criteria for significant growth in the Electric Vehicle (EV) market: abundant renewable energy resources, people travel on average less than 80Km per day, with average speeds of 60Km/h and lastly throughout most of the continent temperatures rarely go below zero. Importantly for a country like Ethiopia, EVs can decrease dependency on petroleum and boost energy security. This is particularly relevant in the wake of the COVID-19 recession and foreign exchange shortage.

There are many good reasons for policy to support the growth of this sector including the ambitious off-grid electrification, the country's green agenda and the logistical challenges of distribution of petroleum products to rural areas. E-mobility has the potential to reduce the costs and increase the reliability of first-mile transport. The first-mile refers to the movement of products from the production place to a logistics service point or distributor and distances can be anything from 0.25km to 200km. Improvement in first mile distribution, typically the most expensive leg of the logistics chain in tonne-km terms, will reduce agriculture waste, and support higher incomes for farmers.

In summary, policy support to address enabling environment barriers and opportunities for e-mobility manufacturers to invest in Ethiopia, will help to kickstart the industry.



Image 1: Sokowatch, the innovative East African e-commerce platform, has launched electric three wheelers, commonly referred to as tuk-tuks, to its delivery fleet in Uganda, making the vehicles the first to be used commercially in East Africa. The new fleet of vehicles take 3 hours to charge and last for approximately 2-3 days, and can carry 500kg in goods.

8. Annex 2: The Water-Energy-Food Nexus

8.1. Ethiopia's NDC

Agriculture, with a focus on livestock and soil, is a priority sector for Ethiopia's NDC. In East Africa, the AFOLU sector represents 67% of net GHG emissions as of 2017 with this figure approaching 80% in Ethiopia. Mitigating GHG emissions while ensuring food security and supporting an agriculture economy will be the greatest challenges for countries in East Africa. Agriculture drives the economy and is responsible for 70% of employment in the region, but it is also responsible for most GHG emissions.⁸ (FAO 2017).

The NDC identifies 86% of the abatement potential to come from the AFOLU sector. The country has committed to a 64% decrease in emissions from the BAU trajectory by 2030 and in order to achieve this, mitigation efforts will need to target agriculture and land use changes. The NDC focuses on the agriculture sector for mitigation by improving crop & livestock production for greater food security & higher farmer incomes while reducing emissions. Another focus is the protection and re-establishment of forests for their economic and ecosystem services and their ability to sequester significant amounts of carbon dioxide. From an adaptation perspective, initiatives to reduce the vulnerability of communities, the environment and the economy are articulated in Ethiopia's Climate Resilient Green Economy (CRGE) Strategy which outlines pathways to achieve resilient economic development. Importantly, NDC targets are conditional on funding support and it is estimated that over USD 7.5 billion investment is needed annually for mitigation and adaptation actions. The NDC notes that the country is interested in carbon trading as a seller of carbon in order to fund climate action.

A recently published global research study gathered on-the-ground perspectives to better understand the social, political and economic factors that support or prevent the adoption of GHG mitigation activities from landscape management and agricultural practices. Although significant differences for different political regions were noted, supporting the argument for a region specific approach in future programme design, a few consistent themes emerged. War, conflict and poverty were widely seen as preventing the adoption of land management practices while access to knowledge, support services, infrastructure as well as land tenure are important elements that support land management practices. The study used the Carbon Benefits Project (CBP) GHG analysis tools (www.carbonbenefitsproject.org) to estimate the net greenhouse gas mitigation potential of a selection of land management strategies. (Evangelista, et al. 2020)

Recent research backed up by practical experience, indicates that a nexus approach can build an understanding of the linkages, enhance resource efficiency, drive policy coherence and address water, energy and food security. The incentives for a nexus approach include economic efficiency, resource efficiency, and improved livelihood options (Bazilian 2011). A nexus approach to policy-making reflects the broad range of skills needed to address development challenges in the sectors and importantly promotes dialogue between different sectors, which drives more integrated outcomes.

⁸ Food and Agriculture Organization of the United Nations. (2017). Supporting Low Emissions Development in the Ethiopian Dairy Cattle Sector: Reducing enteric methane for food security and livelihoods.

9. Annex 3: Funding & Support Resources

1. The World Bank ESMAP Global Mini-grids Facility (<https://www.esmap.org/esmap-mini-grids-global-facility>). ESMAP is a partnership between the World Bank and 19 partners to help low and middle-income countries reduce poverty and boost growth through sustainable energy solutions. ESMAP's analytical and advisory services are fully integrated within the World Bank's country financing and policy dialogue in the energy sector.
2. The AfDB has established the Facility for Energy Inclusion, a commercial debt platform for small-scale renewables with a strong focus on mini-grids with a target of \$400m. FEI aims to improve energy access across Africa through small-scale renewable energy and mini-grid projects and serves as a financing platform to catalyze financial support for innovative energy access solutions. FEI is managed by LHGP Asset Management, part of Lion's Head Group.
3. The Sustainable Energy Fund for Africa has been converted into a larger concessional finance facility with mini-grids as one of three strategic priorities and the ability to do results-based financing.
4. The Mini-Grid Innovation Lab, run by Crossboundary⁹ is an R&D Fund focusing on improving mini-grid business models in Africa. It is exploring 8 cost reduction and revenue increasing innovations that over time could together reduce capex per connection from an average of \$1,000 to \$500, and increase average revenue per user (ARPU) from \$5 to \$17.50 per month. These innovations, being tested by mini-grid developers in the field, include using smart inverters to modularly increase grid capacity, bulk procuring components to reduce installation costs, reducing tariffs to spur consumption, and offering appliance financing for grain mills and other productive use appliances to enable customers to experience the full benefits of electricity.
5. The Universal Energy Facility (UEF), a pan-African results-based-financing facility for off-grid energy, to be managed and scaled by [SEforALL](#).
6. The AfDB's Green Mini-Grids Helpdesk has now supported 107 mini-grid developers in 36 African countries with 46 MW of planned and implemented capacity, over 50,000 planned and implemented connections, an estimated cumulative investment of over \$104 million, and received 98% positive survey feedback from developers.
7. The Renewable Energy Performance Platform (<https://repp.energy/>) is supported with £148m funding from the UK Department for Business, Energy and Industrial Strategy (BEIS) and works to mobilise private sector development activity – and investment – in small to medium-sized projects (typically up to 25MW). To date, REPP has committed £37m in co-financing for the development of 27 contracted projects covering a wide range of technologies, from solar homes systems to grid-connected solar farms and run-of-river hydropower plants.
8. The African Mini-grid Developers Association (AMDA) (www.africamda.org) is Africa's first trade association dedicated exclusively to the mini-grid industry, and is composed of developers operating AC mini-grids that ensure power reliability of at least 20 hours per day. The association also works closely with a variety of solution providers, including EPCs, hardware and software vendors and integrators.
9. The Africa Clean Energy Technical Assistance Facility (<https://www.ace-taf.org/>) launched in June, 2020, is a technical assistance programme focussed on creating enabling environments to catalyse markets for off-grid solutions especially solar home systems. It will also work closely with both Governments, private sector and key stakeholders in the off-grid sector, & in close partnership with the International Finance Corporation (IFC) and the Africa Enterprise Challenge Fund (AECF).

⁹ <https://www.crossboundary.com/labs/>

10. Innovation funding: The French Development Agency (AFD) and the Environment and Energy Management Agency (Ademe) have recently launched a call for projects aimed at young Africans who are developing sustainable off-grid solutions to facilitate access to electricity in Africa. Through this second edition of the programme, some 10 project leaders will receive a budget of €1,600,000 to finance their activities. <https://appelsaprojets.ademe.fr/aap/SolInAE2019-103>, acces.energie@ademe.fr

10. Annex 4: Instruments from the Climate Finance Lab

The Climate Finance Lab, based in San Francisco and launched in 2014, identifies, develops, and launches innovative finance instruments that can drive billions in private investment to action on climate change and sustainable development. Since 2014, they have catalysed more than \$2 Bn in funds and launched 49 instruments that are targeted at mobilising finance that address investment barriers related to climate action.

Many of their instruments address off-grid renewable energy, climate smart agriculture or landscape management and are appropriate for Ethiopia. Below we have summarised the instruments that would help to address the off-grid funding gap or that will assist with the affordability of tariffs by supporting rural household incomes. We recommend engaging with the lab to assess which instruments are ready to be operationalised.

Instrument Name	Instrument and description	Notes
The GreenStreet Africa Development Company Location: Nigeria Energy as a service (Eaas) model allows private ownership, operation & financing for distributed solar projects to supply public facilities	Aggregating individual projects into investable portfolios Financing secured by private placement bonds issued in local currency, backed by 3rd party repayment guarantees.	GreenStreet is partnering with the Nigeria Rural Electrification Fund ("REF") to prepare derisked portfolios of off-grid projects. Projects will be built, owned and operated by private Independent Power Producers (IPPs)
Solar Securitization for Rwanda	Pools loans from multiple solar developers into a tradeable asset backed security.	Off-grid SHS are financed to customers and solar developer relies on their ability to leverage their balance sheet. This is constrained by substantial collateral required
The Water Financing Facility (WFF) A pilot in Kenya was established in early 2017	WFF mobilizes large-scale domestic private investment from institutional investors such as pension funds and insurance companies in support of countries' national priority actions on adaptation and mitigation in the water sector,	Domestic finance raised through the local bond market
Renewable Energy Scale-Up Facility (RESF) To be launched in Latin America and the Caribbean, Middle East North Africa, and Southeast Asia	The Facility will deliver financing to projects in increments as they achieve key development milestones, in exchange for the option to buy equity at financial close, at better-than-market rate terms.	The first fund will target developing countries that have strong investment environments and significant renewable energy potential. This is a solution to drive private institutional equity into earlier stages of renewable energy projects in emerging markets.
Distributed Energy for Cooperatives.	The Distributed Generation for Cooperatives Fund aims to scale	Agriculture cooperatives are a key target. There are nearly

Brazil	up distributed renewable energy (up to 5 MW) by partnering with cooperatives. The instrument will combine a “Pay-per-use contract” with a “Two-part performance structure”	7000 cooperatives in Brazil that together have 372,000 employees and 13,000,000 members. market
The FX Hedging Facility	The FX Hedging Facility reduces the total cost of hedging for the user when compared to the cost of a commercial cross currency swap, by efficiently utilizing public capital.	It is a more efficient use of public grants, or subsidy, as it covers or targets only a certain tranche of the currency risk
The West African Initiative for Climate Smart Agriculture WAICSA will target six of the 15 ECOWAS member states in its pilot phase, with the objective of being replicated in all 15 states after the concept is proven.	A blended finance fund with a specific focus on increasing the uptake of CSA practices by smallholder farmers. Has a financing facility (80% of funds) and a technical assistance facility (20%). It supports financial intermediaries to design loan products that integrate CSA conditionality and guides smallholders in implementing locally adapted CSA practices. Benefits include: • subsidized interest rate loans to smallholders’ organizations and agribusinesses. • builds the capacity of local financial institutions to design loan products with CSA adoption conditions	WAICSA has the potential to improve the food security of 90,000 smallholder farming households in the region and convert over 185,000 hectares to climate-smart agriculture. The fund can also contribute to mitigating up to 2 million tonnes of CO2 emissions a year
The Rural Prosperity Bond. RPB will provide loans to SMEs working in land restoration in Africa, South Asia and Latin America. The RPB will benefit from a partnership with World Resources Institute’s Land Accelerator. This is an entrepreneurship program that provides tailored capacity-building to restoration enterprises. Upon graduation from the accelerator, these SMEs will be able to apply for credit from the bond. The RPB complements the land Accelerator by providing complementary finance.	Much of Africa’s land is degraded. Rural small and medium enterprises working on sustainable agriculture and forestry are crucial to land restoration and the rural economy. these enterprises are too small for commercial banks and too large for microfinance, they have relatively few sources of finance available to them. Consequently, they frequently lack the capital needed to grow their businesses and serve more farmers. These rural communities are already highly vulnerable to climate change and food insecurity, the latter being exacerbated by the current COVID-19 crisis.	One key element is the use of discounted interest rates to incentivize SMEs to boost their social and environmental impact by working closely with smallholders. The Rural Prosperity Bond could mobilize around USD 70 million to supply almost 400 small-size loans to restoration SMEs operating in Africa, South Asia and Latin America. Through the restoration of about 100,000 hectares of land, the Bond has the potential to sequester 850,000t CO2. This is achievable because the instrument can connect SMEs to more than 800,000 farmers, the majority of whom are women.

		By improving the yields of most farmers by at least 40%, and by supporting 18,000 rural jobs, the RPB can contribute to a green recovery post COVID.
Green Aggregation Tech Enterprise (GATE) Addresses revenue risk, a key obstacle to private investment in and the subsequent scale-up of the mini-grid market. GATE guarantees mini-grids a baseline level of revenues. This baseline revenue guarantee ensures that mini-grids can meet debt obligations in the event of revenue shortfalls. Pilot markets Kenya, Nigeria and Zambia	GATE creates a guarantee business that effectively pools mini-grid revenue risk. With GATE, mini-grids pay a premium to gain a guaranteed minimum revenue stream: • The mini-grid agrees to a periodic revenue threshold with GATE, over a fixed time. • The mini-grid pays a regular premium to GATE for each period covered. • In the event that revenue falls below the threshold, GATE pays out the difference. This means that mini-grids can meet their debt obligations in the event of revenue shortfalls. This can transform the financing of mini-grids: from donor grants to debt finance.	GATE transforms mini-grid finances, enabling project debt leverage of 70% and equity returns of 20%. In GATE's pilot phase (2018 – 2023), GATE will enable 60,000 electricity connections.
The Smallholder Forestry Vehicle Under development by Komaza, a smallholder forestry company in Kenya with more than 10 years' experience in partnering with 14,000 smallholder farmers, over half of whom are female, to plant and harvest 3,800 hectares of trees. The only investment mechanism that enables private investors to invest in smallholder forestry in Africa, while also reducing capital costs for forestry companies that provide technical support and market linkages to smallholders. The Vehicle fills a crucial gap in Africa, where extremely limited investment is occurring in forestry.	The Company will work with farmers and their communities to assess land suitability and secure land use rights for tree growing. The land consists of unused, degraded portions of smallholder plots. Once enrolled, farmers contribute land and labor, and are paid a market price for harvested trees. The Company provides training, planting inputs, maintenance support, harvesting services, and a guaranteed market for the trees.	Each Smallholder Forestry Vehicle could restore 15,000 hectares of degraded land, providing each of 50,000 farming households with US\$ 1,500 in climate resilient savings and achieving a modeled 17% gross internal rate of return. Smallholder farmers accumulate wealth similarly to a savings plan, by maintaining trees and receiving payments at thinning and harvest.

Table 9: Innovative financial instruments from the Climate Finance Lab that have the potential to address off-grid funding barriers in Ethiopia.

11. Annex 5: Establishing A Climate Endowment Fund

Although funding for climate action in developing countries is increasing, overall funds flow into sub-Saharan Africa remains well below what is needed to adequately drive mitigation and adaptation outcomes. However there are indications that the momentum for investment in climate action is building and below are a few selected initiatives that suggest that the funding tide is turning:

- The UN established the Principles of Responsible Investment (PRI) in 2006 and has grown to over 3000 signatories representing the largest asset managers on the planet and a total of over USD \$ 100 Trillion in assets under management.
- Climate Endowment Group is a climate impact investment manager with the mission to create large scale positive impact in the fight against climate change through “endowment style” investments as pursued by the Yale Endowment, which has seen average returns of some 12% per annum over the past 30 years versus 3-4% for EU Pension or Insurance Funds. In May 2020 the Climate Endowment Group signed a Memorandum of Understanding with listed Chinese energy company to jointly set up a climate-focused asset manager in Singapore to invest in Asia-Pacific renewable energy projects.
- The Cubango-Okavango River Basin Fund is a USD \$200M endowment fund set up to conserve this unique river system and ecosystem in Southern Africa.

11.1. The Impact Case for the Off-Grid Sector in Ethiopia

Climate change is a cross-cutting challenge faced by all countries. Addressing it effectively requires a range of policy interventions and projects across multiple sectors and geographies. If we evaluate off-grid energy in Ethiopia against the Sustainable development goals, we see that it directly or indirectly addresses 13 of the SDGs. By adopting a water-energy-food nexus approach as articulated in this report, the alignment with the SGGs is even more compelling.

The table below evaluates the alignment between the Ethiopia off-grid programme and the sustainable development goals.

Goal	Comments
1. No poverty	NEP 2.0 estimates that between 80,000 and 200,000 direct full time and part time jobs will be created through the off-grid programme. NEP2.0 also estimates a further 50% to 100% indirect jobs (50,000 to 200,000). Further indirect jobs will be created in sectors such as agriculture.
2. Zero Hunger	Clean affordable energy is a building block of the CRGE and enables agriculture productive uses, particularly ground water irrigation which will have a significant impact on food security.
3. Good health and well being	This is directly related to jobs and improved food security.
4. Quality education	There are many studies that demonstrate the relationship between energy access and education.
5. Gender equality	Access to reliable off-grid household energy and public lighting can reduce energy poverty and give women and men additional income-earning opportunities. NEP 2.0 addresses gender equality as a key implementation objective of the programme.

6. Clean water and sanitation	NEP 2.0 addresses clean water and sanitation as a targeted outcome of the off-grid programme. Water pumping is listed as a targeted productive use of the off-grid programme and sanitation is enabled by energy.
7. Affordable clean energy	Clearly the Ethiopia off-grid programme directly addresses this goal.
8. Decent work and economic growth	See goal 1
9. Industry, Innovation and Infrastructure	Off-grid energy enables productive use of infrastructure and innovation in the agriculture sector which dominates the rural economy.
10. Reduced inequalities	Yes
11. Sustainable cities and communities	Yes
13. Climate Action	The Ethiopian off-grid sector addresses both adaptation and mitigation outcomes.
15. Life on land	Addressing improved agriculture productivity has direct benefits for ecosystems by reducing the need to farms to expand pastures and fields for cultivation.

Table 10: The outcomes of the Ethiopia off-grid programme are highly aligned with the Sustainable Development Goals.

In addition to the alignment with the SDGs, the off-grid programme addresses a number of the climate change solution areas described in Project Drawdown.¹⁰

In summary, for asset managers looking for diversification into projects aligned with climate action and the SDGs, this represents an interesting set of opportunities.

¹⁰ <https://drawdown.org/>

12. Annex 6: Endowment Fund Modelled

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
	Endowment Capital	\$ 400,000,000	\$440,000,000	\$484,000,000	\$532,400,000	\$ 585,640,000	\$644,204,000	\$708,624,400	\$ 779,486,840	\$857,435,524	\$943,179,076	
	Capital fund growth		10%	10%	10%	10%	10%	10%	10%	10%	10%	
4%	Gross Investment Funds	\$ 16,000,000	\$ 17,600,000	\$ 19,360,000	\$ 21,296,000	\$ 23,425,600	\$ 25,768,160	\$ 28,344,976	\$ 31,179,474	\$ 34,297,421	\$ 37,727,163	\$ 254,998,794
10%	Management Costs	\$ 1,600,000	\$ 1,760,000	\$ 1,936,000	\$ 2,129,600	\$ 2,342,560	\$ 2,576,816	\$ 2,834,498	\$ 3,117,947	\$ 3,429,742	\$ 3,772,716	\$ 25,499,879
	Net Investment Funds	\$ 14,400,000	\$ 15,840,000	\$ 17,424,000	\$ 19,166,400	\$ 21,083,040	\$ 23,191,344	\$ 25,510,478	\$ 28,061,526	\$ 30,867,679	\$ 33,954,447	\$ 229,498,914
80%	Concessional debt	\$ 11,520,000	\$ 12,672,000	\$ 13,939,200	\$ 15,333,120	\$ 16,866,432	\$ 18,553,075	\$ 20,408,383	\$ 22,449,221	\$ 24,694,143	\$ 27,163,557	\$ 183,599,131
15%	Grants	\$ 2,160,000	\$ 2,376,000	\$ 2,613,600	\$ 2,874,960	\$ 3,162,456	\$ 3,478,702	\$ 3,826,572	\$ 4,209,229	\$ 4,630,152	\$ 5,093,167	\$ 34,424,837
5%	Working capital loans	\$ 720,000	\$ 792,000	\$ 871,200	\$ 958,320	\$ 1,054,152	\$ 1,159,567	\$ 1,275,524	\$ 1,403,076	\$ 1,543,384	\$ 1,697,722	\$ 11,474,946
Concessional Debt Scenarios in a blended structure												
	Leverage Factor 2x	-	2	2	2	2	2	2	2	2	2	
	Leveraged Funds	\$ -	\$ 25,344,000	\$ 27,878,400	\$ 30,666,240	\$ 33,732,864	\$ 37,106,150	\$ 40,816,765	\$ 44,898,442	\$ 49,388,286	\$ 54,327,115	\$ 344,158,263
	Total Blended facility at 2x	\$ 11,520,000	\$ 38,016,000	\$ 41,817,600	\$ 45,999,360	\$ 50,599,296	\$ 55,659,226	\$ 61,225,148	\$ 67,347,663	\$ 74,082,429	\$ 81,490,672	\$ 527,757,394
	Leverage Factor 3x	-	3	3	3	3	3	3	3	3	3	
	Leveraged Funds	\$ -	\$ 38,016,000	\$ 41,817,600	\$ 45,999,360	\$ 50,599,296	\$ 55,659,226	\$ 61,225,148	\$ 67,347,663	\$ 74,082,429	\$ 81,490,672	\$ 516,237,394
	Total Blended facility at 3x	\$ 11,520,000	\$ 50,688,000	\$ 55,756,800	\$ 61,332,480	\$ 67,465,728	\$ 74,212,301	\$ 81,633,531	\$ 89,796,884	\$ 98,776,572	\$108,654,230	\$ 699,836,526
	Leverage Factor 4x	-	4	3	3	3	3	3	3	3	3	
	Leveraged Funds	\$ -	\$ 50,688,000	\$ 41,817,600	\$ 45,999,360	\$ 50,599,296	\$ 55,659,226	\$ 61,225,148	\$ 67,347,663	\$ 74,082,429	\$ 81,490,672	\$ 528,909,394
	Total Blended facility at 4x	\$ 11,520,000	\$ 63,360,000	\$ 55,756,800	\$ 61,332,480	\$ 67,465,728	\$ 74,212,301	\$ 81,633,531	\$ 89,796,884	\$ 98,776,572	\$108,654,230	\$ 712,508,526
Concessional debt repayment modelled: assumes principal is repaid starting in year 2 over 10 years at 0% interest												
	\$	11,520,000	\$ 12,672,000	\$ 13,939,200	\$ 15,333,120	\$ 16,866,432	\$ 18,553,075	\$ 20,408,383	\$ 22,449,221	\$ 24,694,143	\$ 27,163,557	\$ 183,599,131
				\$ 1,152,000	\$ 1,152,000	\$ 1,152,000	\$ 1,152,000	\$ 1,152,000	\$ 1,152,000	\$ 1,152,000	\$ 1,152,000	\$ 9,216,000
					\$ 1,267,200	\$ 1,267,200	\$ 1,267,200	\$ 1,267,200	\$ 1,267,200	\$ 1,267,200	\$ 1,267,200	\$ 8,870,400
						\$ 1,393,920	\$ 1,393,920	\$ 1,393,920	\$ 1,393,920	\$ 1,393,920	\$ 1,393,920	\$ 8,363,520
							\$ 1,533,312	\$ 1,533,312	\$ 1,533,312	\$ 1,533,312	\$ 1,533,312	\$ 7,666,560
								\$ 1,686,643	\$ 1,686,643	\$ 1,686,643	\$ 1,686,643	\$ 6,746,573
									\$ 1,855,308	\$ 1,855,308	\$ 1,855,308	\$ 5,565,923
										\$ 2,040,838	\$ 2,040,838	\$ 4,081,677
											\$ 2,244,922	\$ 2,244,922

Table 11: High level view of the fund over 10 years.

Commercially priced debt will be at a premium on sovereign debt. In Ethiopia this will be in the region of 10 – 12% in dollar terms. The endowment funds can be used in a blended structure with commercial debt as modelled in the table below. We assuming a principal of USD 300,000, which is a reasonable assumption for a 60:40 debt:equity split for an 'average' size mini-grid with a capital cost of USD \$500,000.

The debt is comprised of commercial debt at 10% per annum with a 10 year tenor and 0% interest endowment debt. The blended interest rate at leverages from 1 – 5 x illustrates how leverage multiple will need to trade-off with the blended interest rate.

Leverage	5	Interest	term (yrs)	Annual repayment (capital + interest)
Commercial	\$ 250,000	10%	10	\$ (40,686)
Concessional	\$ 50,000	0%	10	\$ (5,000)
Blended	\$ 300,000	8.5%	10	\$ (45,686)

Leverage	4	Interest	term (yrs)	Repayment
Commercial	\$ 240,000	10%	10	\$ (39,059)
Concessional	\$ 60,000	0%	10	\$ (6,000)
Blended	\$ 300,000	8.2%	10	\$ (45,059)

Leverage	3	Interest	term (yrs)	
Commercial	\$ 225,000	10%	10	\$ (36,618)
Concessional	\$ 75,000	0%	10	\$ (7,500)
Blended	\$ 300,000	7.7%	10	\$ (44,118)

Leverage	2	Interest	term (yrs)	
Commercial	\$ 200,000	10%	10	\$ (32,549)
Concessional	\$ 100,000	0%	10	\$ (10,000)
Blended	\$ 300,000	6.9%	10	\$ (42,549)

Leverage	1	Interest	term (yrs)	
Commercial	\$ 150,000	10%	10	\$ (24,412)
Concessional	\$ 150,000	0%	10	\$ (15,000)
Blended	\$ 300,000	5.3%	10	\$ (39,412)

Table 12: This table demonstrates the inverse relationship between concessionality and leverage.

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