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SCOPING ASSESSMENT OF SUB- SECTOR OPPORTUNITIES FOR NDC IMPLEMENTATION IN ETHIOPIA

29 May 2018





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List of Abbreviations

Abbreviation	Full Title
CDKN	Climate and Development Knowledge Network
CRGE	Climate Resilient Green Economy (Strategy) of Ethiopia
DFID	Department of International Development, United Kingdom
EEU	Ethiopian Electric Utility
GCF	Green Climate Fund
GHG	Greenhouse Gas
GIZ	German Society for International Cooperation
GoE	Government of Ethiopia
GTP	Growth and Transformation Plan
IFC	International Finance Corporation (private sector arm of the World Bank Group)
INDC	Intended Nationally Determined Contributions
IPP	Independent Power Producers
MFI	Micro Finance Institutions
MoFEC	Ministry of Finance and Economic Cooperation
MoWIE	Ministry of Water, Irrigation and Electricity
NEP	National Electrification Program
NDC	Nationally Determined Contributions
NGO	Non-Government Organization
PAYG	Pay As You Go payment system
PPAs	Power Purchase Agreements
PV	Photovoltaic
R&D	Research and Development
REB	Regional Energy Bureau
REF	Rural Electrification Fund
SDG	Sustainable Development Goals
SHS	Solar Home Systems
UEAP	Universal Electricity Access Program
USD	United States Dollar
WB	World Bank



Executive Summary

The 'Mobilising Investment (MI) for Nationally Determined Contribution (NDC) Implementation' project is an International Climate Initiative (IKI) funded project which focuses on stimulating private sector investment into priority sub-sectors within seven target countries: Bangladesh, Dominican Republic, Ethiopia, Kenya, Peru, Philippines and Vietnam supported by the German government.

This report seeks to present the findings and conclusions of the scoping analysis of sector and sub-sector opportunities in Ethiopia. The purpose of the study was to identify priority sector and sub-sector opportunities which hold the greatest potential in mobilizing private investment while aligning with the Ethiopian NDC. The ultimate goal of the study was to identify one sub-sector opportunity that would be taken forward into the later phases of the project which would focus on the creating a favourable environment for private investment. During the initial analysis, the energy sector showed the most promise in terms of mobilising private sector investment. The study, therefore, concentrated on sub-sector opportunities within the energy sector, with a detailed investigation into the following six sub-sector options/initiatives:

- Mini-grids;
- Expanding local manufacturing for off-grid technologies;
- Developing local entrepreneurship using World Bank funds;
- Greening industry parks;
- Expanding the National Biogas Programme in Ethiopia;
- Investigation of the use of bio-ethanol as a charcoal replacement; and,
- Scaling up the Cookstoves industry.

Ultimately, the mini-grids sub-sector solution was considered to be the most appropriate and viable for investigation in the next phase of IKI MPI. The reasons for its selection were as follows:

- Grid coverage and extending energy access: Off-grid solutions should be viewed as complementary technologies to grid-based electricity. The Ethiopian government has set an ambitious target of 50% grid access by the year 2050. The question remains about the remaining 50% of the population particularly those living in deep rural areas away from the grid access. Mini-grids can provide a stable, low-cost solution that can extend energy access;
- Mini-grids present a bottom-up approach which could catalyse Ethiopian-owned businesses: Certain sub-sectors may be useful in addressing energy access issues however the business opportunities presented are taken up by international companies and investors. Mini-grids could allow for the creation of ESCOs which are locally owned as well as a host of other co-benefits including job creation and poverty alleviation.
- Some of the initiatives identified to remediate barriers in different sub-sectors were considered in the context of the goals and objectives of the project. Addressing barriers such as licensing issues of mini-grids was deemed to be more viable in the timeframe of the project as opposed to developing a strategy for local manufacturing of solar products, for example.
- High-level policy buy-in: The Government of Ethiopia has already explicitly stated in the NEP that private sector engagement in off-grid solutions will be endorsed.



1. Introduction

The Mobilising Investment (MI) for Nationally Determined Contribution (NDC) project is an International Climate Initiative (IKI) funded project which focuses on stimulating private sector investment into priority sub-sectors within seven target countries: Bangladesh, Dominican Republic, Ethiopia, Kenya, Peru, Philippines and Vietnam supported by the German government. The overarching project objective is to support public actors and the private sector to create favourable conditions for private financing of NDC implementation by incentivising investments and increasing scale of demand. In doing so, this project seeks to strengthen national capacities and learning on financing NDCs by working through some of the practical challenges actors face.

The first step of the scoping process identified key economic sectors (energy, forestry, agriculture, industry) in Ethiopia while the second step investigated which of these sectors are able to mobilise the private sector engagement while adhering to the goals and objectives of the Ethiopian NDC. During the preliminary analysis, which entailed a systematic analysis of sectors and in-country interviews, the energy sector was determined to be the most viable sector to catalyse private sector interest, with a focus on mini-grids.¹ The sections that follow outline elements of the energy sector; case studies of specific sub-sector opportunities within the energy sector; and, an analysis of the sub-sectors that led to the decision of a specific sub-sector opportunity to be taken forward through to the implementation phases of the project.

1.1. Energy

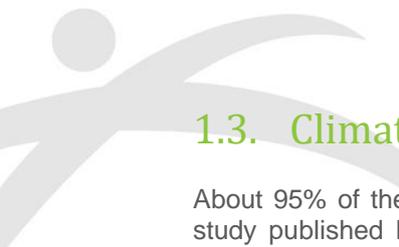
Ethiopia has shown significant economic growth recently but substantial needs remain for rural energy access and poverty alleviation. The second Growth and Transformation Plan (GTP II) of Ethiopia (FDRE, 2016), targets reducing the percentage of the population below the poverty line to 16.7% by 2019/20 from a baseline of 30% in 2017. National energy access stands at 28%, and only 10% of this figure is in rural areas. Per capita energy consumption remains low, at less than 100kWh/annum, well below the sub-Saharan average of 540kWh/annum in 2010 (Central Statistical Agency and ICF, 2017). The average rural and urban household size is 5 and 4.6 persons respectively, with a per capita income of USD739, which is well below the regional average (Central Statistical Agency and ICF, 2017). Approximately 70% of Ethiopians rely on traditional biomass for household cooking. An estimated 16.5 million clean cookstoves have been distributed, which still leaves just over 25% of the population without access to fuel-efficient cooking solutions.

Ethiopia possesses substantial hydropower resources estimated at around 45 GW of exploitable energy of which less than 5% is currently utilized. Hydropower is the main component of the planned generation under GTP II, which details 11 GW of new capacity as well as a major exporter of power, currently selling to Djibouti (350GWh), Kenya (14,000GWh) and Sudan (7GWh).

1.2. Economic Growth Objectives for the Energy Sector

The priority economic growth objectives in the GTP are to increase agricultural productivity and production as well as to accelerate growth in industrial sectors. The energy sub-sector is identified as one of the key enablers to increase agricultural productivity and industrialization. Energy supply plays a key role in the planned GDP growth of the country and the achievement of the SDGs, through freeing up productive time and through improved health. Alongside directly contributing to the GTP, the energy sector plays a significant role in wider macro-economic stability – nearly 62% of foreign exchange (Forex) earnings are spent on petroleum imports. Exporting energy to the neighbouring countries is one of the targets set in the GTP II so to increase Forex earnings and improve the balance of payments.

¹ Even the energy supply is mostly provided by hydropower (89%) in Ethiopia and therefore the emission reduction opportunities are less so than in other sectors such the AFOLU sector, the energy sector has the highest potential in terms of mobilizing private sector involvement and investment. This is owing to the tangibility of the sector, the tariffs associated with energy produced and the risks that are present within other sectors that may deter the private sector.



1.3. Climate Change Objectives of the Sub-Sector

About 95% of the electricity generation in Ethiopia comes from hydro power plants. Furthermore, a study published by van der Zwaan et al. (2017) using two distinct stringent models mimicking an extreme climate change scenario reveals that the future hydro power generation could be between 71 and 87 TWh/yr by 2050, which matches the expected national hydropower potential as in the Climate Resilience-Energy Strategy.

In the context of energy requirements, the strategy document and the study both outline that the effect of climate change will be felt more on wood fuel availability for the poor rural and urban households and the agrarian community mainly in the North of Ethiopia. The CR strategy for water and energy underlines that in order to ensure that power generation is not compromised due to climate change or other unforeseen parameters, two strategic priorities have been outlined; 1) Diverse Energy Mix and 2) Improved Energy Efficiency.

The following strategic priorities have been outlined in the CRGE Strategy to address the core potential challenges identified above:

Diversifying energy mix – the CRGE vision is for a zero net carbon economy by 2025, with an ambition to generate all our electricity from renewable energy resources with up to 20% wind and solar, 10% geothermal and 70% hydropower. The National Action Plan of the Sustainable Energy for All Africans (SE4ALL) program (to which Ethiopia is a signatory member) includes the focus area for diversification through the installation of geothermal power plants, wind farms and solar systems.

Improving energy efficiency – increasing energy efficiency will reduce the demand for electricity. Efficient lighting and motors could reduce energy demand by 7,930GWh in 2030 (12% of total energy sales) and peak power demand by 1,474MW in 2030 (12% of total peak demand).

Improving efficiency of biomass use – reducing the demand for biomass by increasing fuel efficiency. The National Improved Cookstoves Program can contribute significantly to reducing demand.

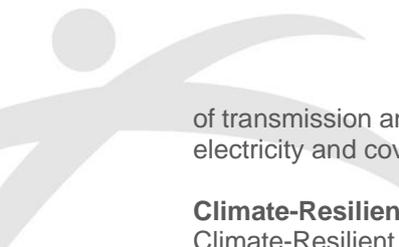
Accelerate non-grid energy access – the Rural Electrification Fund (REF) needs to be enhanced to deliver at scale. Pilot micro-generation projects need to be funded to demonstrate the potential for mini- and micro-grid solutions.

1.4. Legislation and Policy Relevance

Following release of the Government's National Energy Strategy (NES–2016) and reflecting its recommendations, Ethiopia's National Electrification Program —Implementation Roadmap (NEP-IRM) was developed in late 2017. The NEP presents the Government's action plan for achieving Universal Electricity Access nationwide by 2025 or end of the GTP III period. Outlined in the plan is to expand grid connectivity to existing grid infrastructure in terms of grid densification nearly five-fold from today's numbers to over 14 million households covering about 65% of the total population and access to electricity through off-grid systems to the remaining 5.7 million households representing about 35% of the population in 2025. It has been estimated that a total of USD 1.5 billion is required in the first phase (2018 – 2022) of implementation to achieve a target of one million last-mile household connections, of which USD 484 million will be required for off-grid solutions². The Ethiopian Electric Utility (EEU) will be the primary agent through which the NEP shall be implemented. To achieve its off-grid targets, the NEP outlines that proven international experience from Kenya, Bangladesh, Argentina and Peru shall be replicated with respect to implementation and financing frameworks.

Growth and Transformation Plan: The November 2010 Growth and Transformation Plan (GTP 2015/20) is the current Ethiopian government's guiding document for broad economic development through to 2020. GTP II is the successor to the GTP I (2010/15); Plan for Accelerated and Sustained Development to End Poverty (PASDEP) -2006/10 and Hydropower Development Strategy (HDS) – 2001/06. The GTP quantifies electric power-related targets, and provides policy guidance in such areas as hydro/solar/wind/geothermal and alternative energy -electric power generating capacity, total length

² *National Electrification Programme, 2017*



of transmission and distribution lines, power waste reduction, and number of consumers with access to electricity and coverage of electricity services.

Climate-Resilient Green Economy Strategy (CRGE): The Ethiopian government published its Climate-Resilient Green Economy Strategy (CRGE) in 2011. CRGE asserted four pillars of its green economy development strategy, among them was to expand electric power generation from renewable sources of energy for both domestic and neighbouring markets. CRGE addresses, at a high level, the need to increase expenditures in electric power generation, noting that such increases could occur “via a combination of tariff adjustments and the attraction of private capital.” Electricity tariffs in Ethiopia however have not been adjusted for years and are way below current cost-reflective levels making it the cheapest in the world. This has been one of the main reasons that resulted in a depressed interest from the private sector to invest in the Energy Sector in Ethiopia. To this end, the Electricity Feed-in-Tariff proclamation was developed in 2012, but has never been endorsed³.

The Scaling-Up Renewable Energy Program (SREP) in Ethiopia is a USD 50 million highly concessional project that aims to scale investments in Wind, Geothermal and small and medium-sized enterprises (SMEs) Renewable Energy Projects. Furthermore, the program has established a renewable energy SMEs financing facility in an effort to increase the local population’s access to renewable energy technologies by creating a solid supplier base. The latter component, which is also known as “Lighting Ethiopia”, focuses on building the capacity of Market players followed by financing the same players in the second phase of the project. Lighting Ethiopia will mainly focus on removing barriers to the development of a strong supplier base for clean energy products that help meet the Government’s energy access and GHG emission priorities, and provide access to modern energy services to bottom-of-the-pyramid (BoP) households. Lighting Ethiopia will also provide SMEs access to market intelligence; business plan development; technology appropriateness; and management training to develop the market for clean energy in Ethiopia.

National Electrification Plan: The NEP is the recent guiding document to enable access to energy for all by 2025. The use of Geothermal, Wind and Solar farms has been designated to supplement grid connections and diversify the national energy mix whilst off-grid areas shall have access to energy through micro/mini grids and solar home systems (SHS). The plan of action proposed by the NEP-IRM aims for a substantially redesigned off-grid program, broadly organized into four sub-program components. The overarching objectives of each component will be dependent on four strategic drivers, which include:

- **Scale and speed of program delivery** - scaling up the off-grid access implementation over one million new households per year, on average, over the period 2019 through 2025;
- **Spatial reach of the off-grid program** - priority focus on the underserved rural and deep rural area beneficiaries where the majority of the nation’s population lives, with incomes under \$2 per day (55 ETB per day), and where the development need and imperativeness of inclusion is paramount;
- **Priority for solar systems** - priority to increasing the penetration of solar systems in rural and deep rural areas;
- **Institutional framework** - NEP-IRM strategy aims to enable both public sector and private sector-based delivery modalities to roll out off-grid access.

Going forward, the NEP calls for a detailed design study to be undertaken in 2018, informed by the results of the national geo-spatial least-cost access rollout plan, to prepare a detailed operational off-grid program on par with best practices for the four operational sub-program components. As a head start to the planned off-grid detailed operational design study planned for 2018, the Government is considering—in the interim—the development of an Off-Grid Strategy to broadly structure the strategic pillars and drivers of the NEP Off-grid Program. The strategy will be informed by best practices that have scaled up fast, and in a sustainable manner, and off-grid technologies in their respective NEPs that are directly relevant for Ethiopia’s target of achieving 5.7 million off-grid access connections for pre-electrification within eight years’ time (2018–2025) and universal access by 2025. The strategy will in turn inform the detailed implementation operational design to be developed in 2018.

³ *EuropeAid/134039/C/SER/Multi (2016); The EU's Technical Assistance Facility for the Sustainable Energy for All initiative– Eastern and Southern Africa*



1.5. Climate Change Mitigation Potential

The GE Strategy identified and has prioritized more than 60 initiatives, to enable the achievement of the development goals while limiting greenhouse gas emissions in 2030 to today's levels (150 MtCO_{2e}). The initiatives relating to energy would avoid 104.1 MtCO_{2e} (41%) of the total 250 MtCO_{2e} in 2030.

1.6. Overarching Energy Actors and Stakeholders

The responsible ministry is the Ministry of Water, Irrigation and Electricity (MoWIE), under which there are three main implementing institutions: Ethiopian Electric Power (EEP), Ethiopian Electric Utility (EEU) and the Ethiopian Energy Authority (EEA).

ETHIOPIAN ELECTRIC AUTHORITY (EEA) – REGULATOR:

Consistent with its mandate, the EEA will have licensing and regulatory oversight, including for private sector entry, across the functional value chain of generation, transmission, distribution, and sales functions within the power sector. The regulator will be responsible for establishing standards and regulations required for the implementation of the grid and off-grid programs, including social, safety, and environmental safeguards, as well as their compliance. More specifically, the EEA will define and enforce: licensing requirements, rights and obligations of parties, amendments, and certificates of competency. It will also advise the Government on tariff proposals submitted by a licensee (for grid and off-grid). It will also promote energy efficiency and conservation and standards for electric equipment, appliances, and labelling. Finally, it will be responsible for settlement of disputes, mediation, and arbitration.

ETHIOPIAN ELECTRIC POWER (EEP) – OPERATOR:

Ethiopian Electric Power (EEP) established in 2013 is responsible for generation and transmission of 132kV and above. Therefore, the EEP is mandated to engage in large-scale hydro/geothermal/solar and wind power generation and transmission to the power grid.

ETHIOPIAN ELECTRIC UTILITY (EEU):

EEU will be responsible and accountable for network planning, design, and implementation of the grid component. As part of the unbundling program, the UEAP has been integrated within the EEU in January of 2016. EEU will prepare a NEP operations program manual as the umbrella framework to plan, procure, organize, construct, and connect new customers to the distribution network, irrespective of the funding source, while proceeding with the extension of the grid.

Off-grid program—Consistent with the strategic directions outlined for the off-grid connections rollout program, and building on the results achieved to date, an expanded set of best-practice experiences will be deployed for scale-up through;

1. Public sector delivery in deep rural areas—REF unit redesigned (solar systems); EEU (solar systems and mini-grids);
2. Private sector market-based supply, delivery, and after sales service chains in rural areas, with a focus on solar systems; and
3. Private sector mini/micro grids predominantly for pre- electrification in rural areas until the outreach of the grid distribution network access is extended.



2. Outline of Case Studies

2.1. Solar

2.1.1 Mini-Grids

About a quarter of the Ethiopian population had access to energy in 2016, with even lower access rates of nearly a tenth among the rural population. Although on-grid electrification extends to most regions in the country, areas outside the capital (Addis Ababa), including areas close to the borders remain underserved (African Development Bank, 2017). The second Growth and Transformation Plan (GTP II), which runs until 2020, identifies off-grid electrification as a potential solution to servicing energy poor households, especially in rural areas (African Development Bank, 2017). The GTP II recognises Independent Power Producers (IPPs) as key drivers of new on-grid and off-grid generation. Currently, Ethiopia is undergoing legislative, institutional and policy changes in order to create an enabling environment for private sector investment to deliver on off-grid solutions. Under the GTP II, mini-grids are prioritised over standalone solar home systems (SHS), owing not only to their greater rural development potential, but also for their technical and economical viability, when compared against extending the main grid (FDRE, 2016). Thus, GTP II considers hydro, wind and geothermal as potential technologies for mini-grid development. While solar technology exhibits potential, it has not been a focus of government policy and in addition, there are currently no government commissioned solar projects operational or under construction (FDRE, 2016; African Development Bank, 2017). The GTP II does however acknowledge that a major barrier for the use of wind as the primary generation source of mini-grids in Ethiopia is its seasonal and daily variation.

The NEP has outlined that 5.7 Million HH's in the rural parts of Ethiopia shall be powered by off-grid systems by 2025. The REBs have outlined their annual plan and are working to meet with the NEP targets. To this end, two main issues have remained to be a bottle neck for the REB to meet with the targets;

1. Unavailability of FX to import the required panels or even purchase the Solar Panels locally to setup the minigrids in the rural parts of Ethiopia; and
2. Unavailability of clear tariff rates has made the IPPs shy away from the business of distributing power to rural households;

Table 1 below shows some existing barriers hindering the development of mini-grids by the private sector, including opportunities working towards eliminating some of these barriers:

2.1.2 Local Manufacturing of Solar Products

The Government of Ethiopia devised a twin track strategy, which involves grid expansion and off-grid delivery models for implementation of its commitment to meet its target set under GTP II and NDC. The National Electrification Program (NEP) and its implementation roadmap identified on-grid and off-grid electrification approach was released in late November 2017 to ensure accelerated electrification in both urban and rural settlements.

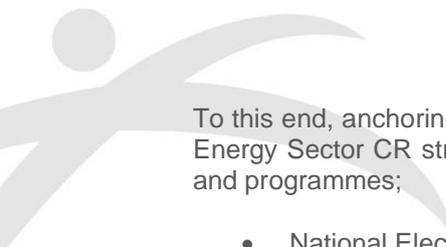
The NEP presents the Government's action plan for achieving Universal Electricity Access nationwide by 2025 or end of the GTP III period. Outlined in the plan and specific to off-grid systems, the program plans to expand rural electricity to 5.7 million households representing about 35% of the population (38 million people). It has been estimated that a total of USD 484 million will be required to achieve the targets outlined for off-grid solutions⁴. A Public Private Partnership model led by the Ethiopian Electric Utility (EEU) is envisaged to be rolled out to meet with the targets for universal access of national electric demand. The strategy will focus on the use of Solar Home Systems and mini-grids as deemed appropriate.

⁴ National Electrification Programme, 2017

Table 1: Barriers and Opportunities Towards Developing Mini-Grids

	Barriers	Opportunities
Tariffs	<ul style="list-style-type: none"> High tariff rates for mini-grid supplied electricity (between 20 and 30 US cents/kWh) presently challenge the prospect of operating an economically viable mini-grid on RE in Ethiopia, when compared to the subsidised national flat on-grid tariff (varying from 2 to 3 US cents/kWh). As such, the off-grid tariff does not allow for full cost recovery, neither does the on-grid tariff capture the real economic cost for supplying to remote areas, which if accounted for, would make the on-grid tariff in rural areas much higher than the mini-grid tariff 	<ul style="list-style-type: none"> A review of the national tariff structure is proposed under the National Electrification Strategy
Uncertainty and Quality Assurance	<ul style="list-style-type: none"> Involvement of private developers in mini-grids deployment in Ethiopia is hindered by two factors: uncertainty and quality assurance. Private developers are reluctant to enter the market because it is uncertain, as to what would happen if the grid were extended to an area where mini-grids are already in place. Issues with the import of solar products due to the lack of capacity of the standards testing authority – the Ethiopian Conformity Assessment Enterprise Current planning timescales are limited to 1 or 2 years, which are too short to provide certainty in the market, especially for mini-grid projects that may have a longer break-even point. Also, no protection or compensation legislation for off-grid projects against future grid connection; national utility is not obliged to buy excess power. 	<ul style="list-style-type: none"> The National Electrification Plan, in line with on-going donor support, targets the development of planning capacity, including development of a geospatial planning framework.
Subsidies and incentives	<ul style="list-style-type: none"> No off-grid specific incentives or subsidies exist Micro-financing institutions do not allow for credit services at favourable rates for rural communities 	<ul style="list-style-type: none"> The WB-DBE Credit Line supports renewable energy and energy efficiency through concessional loans to generate working capital for developers General investment incentives are available, such as the duty-free import of machinery and equipment
Licensing	<ul style="list-style-type: none"> The National Electrification Strategy identifies the barrier of insufficient clarity for the licencing process of off-grid investments, including the lack of capacity. 	<ul style="list-style-type: none"> Private developers are able to obtain transmission, generation and distribution and sale licences
Planning and Institutional setting	<ul style="list-style-type: none"> The short-term and poor planning capabilities within the government and regional authorities limit the effectiveness of electrification programs Reduced public energy sector activities due to recent changes to the institutional structure, responsibilities and mandates of key institutions. 	<ul style="list-style-type: none"> The National Electrification Program (NEP) is the dictated Universal energy access programme, including grid and off-grid Off-grid projects and areas identified under GTP II, while The National Electrification Strategy addresses key energy sector challenges, including proposing a number of off-grid specific initiatives.
Power purchase agreements	<ul style="list-style-type: none"> No standard PPAs for mini-grids exist; although a feed-in-tariff law was drafted in 2012 it has not been operationalized as the government decided to favour an auction or tender based approach. 	<ul style="list-style-type: none"> Private and independent power producers and distributors can operate in Ethiopia Grid generation under GTP II is set for delivery through PPAs.
Information and Awareness Related Barriers	<ul style="list-style-type: none"> Information on mini-grids in Ethiopia is scanty for investors on aspects of resource potentials, available provisions, tax regime, and possible benefits on mini-grids development, including lessons learned and experiences on Ethiopian pilot projects. Above all, there exists no central 'learning/knowledge platform', which would act as a platform for new potential developers to access tips and lessons learned. Data availability is a constraint to energy sector development. There is a need for greater availability of geospatial data, including the digesting of government data on national grid infrastructure and the production of a renewable energy atlas. 	

Source: African Development Bank (2017); Ecofys and SNV Ethiopia (2016)



To this end, anchoring on existing policy and strategy frameworks (GTP II; CRGE strategy, INDC and Energy Sector CR strategy); the MoWIE is developing the following off-grid specific strategies, plans and programmes;

- National Electrification Program (NEP) – November 2017;
- Draft legislation for PPP to develop infrastructure projects - approved;
- Revision of tariff regulations to attract Independent Power Producers (IPP's) - Draft;
- National geo-spatial least cost access rollout plan to inform the development of a detailed study (below) and de-risk private sector investment - undergoing;
- An off-Grid implementation strategy to inform the development of a detailed study (below) - undergoing; and
- Detailed design study to be commissioned in 2018 to prepare a detailed off-grid operational program for the year 2019 – 2022 and beyond - undergoing;

The Energy Sector review document has identified the various policy and regulatory barriers including the financial and capacity challenges that need to be addressed in order for the NEP off-grid targets to be attained. The MoWIE, DfID, USAID, GIZ, NRECA International amongst others have supported the Government of Ethiopia (GoE) in designing and implementing pertinent initiatives and programmes to curb these challenges. In light of this however, the Forex issue stands out as to be the most pressing and challenging task that requires a strategic initiative to ensure a sustainable solution. The IFC-WB Lighting Africa program has been the main driver to support the development of the market for off-grid solar lighting in Ethiopia and has provided USD 40 million for private sector enterprises and small business to access financing through the Market Development for Renewable Energy & Energy Efficient Products Credit Line. However, the program still notes that there is a need to finding a longer-term solution to the existing Forex constraints.

A case study titled⁵ “Drivers of Successful Off-Grid Connections: Amhara Regional Energy Bureau” has revealed that supply of off-grid equipments has not been able to meet with the demand that is seen on the ground. Depending on the economic status of the households, the request for off-grid products being placed at the Regional Energy Bureau ranges from solar lantern products that are able to power a bulb or two upto solar systems that are able to power television and refrigerotar sets. Main factor that was highlighted as the bottle neck for the supply-demand imbalance is the unavailability of FX for the private sector to import these products and deliver them to the last mile.

A recent study in rural Kenya found that, on average, households spend around 3% of income on lighting, rising to 8% (\$1.60 per month) for the poorest quintile. With the acquisition of a solar light, the average number of kerosene lamps in use drops from 2.2 to 1.3, and expenditure on energy drops by 40-60% (\$0.96 per month on average). Households whose solar lights also have phone-charging capability make additional savings (\$0.08 per month), as a result of being able to charge phones for free⁶.

Further, 60% of customers who used kerosene lamps before switching to solar associated an improvement in health with reduced use of kerosene, including a reduction in coughing, flu-like symptoms, eye irritation and respiratory illness. Solar lights also reduce the risk of fire and accidents and improve safety and security. With safer and brighter homes, children studying better at school and with more income available, families have a better quality of life.

According to UNEP en.lighten, off-grid solar employs around 30 people per 10,000 people living in rural areas, compared to just one person per 10,000 people in the case of kerosene⁷.

The NEP plans to provide off-grid energy to 35% of the poorest households in the rural parts of Ethiopia by 2025. To this end, a study revealed that reaching 10% of the rural population through mini grid systems by 2025 could generate a cumulative GHG emission reduction of near to 8 Mton⁸. This figure will only account for reductions of GHG as a result of deploying Mini Grid systems and providing energy

⁵ *A Case Study by Power for All; Supported by DFID, 2018*

⁶ *State of Electricity Access, World Bank, 2017*

⁷ *Renewable Energy and Jobs, IRENA, 2016*

⁸ *Off-Grid Rural Electrification in Ethiopia; NAMA developed with the Mitigation Momentum Project; MoWIE, SNV, Ecofys; 2016*



to only 10% of the estimated 35% of the most poor. Clear analytical GHG data is unavailable to estimate the GHG reductions attributed from the assumption that the remaining 25% households receive energy through SHS and or lantern systems.

Scaling up access to reliable and affordable modern energy services has proved an essential driver for sustainable economic growth in both industrialized countries and emerging economies. It is undeniable that access to modern energy services can significantly contribute to efforts to eradicate poverty; increase food security; provide access to clean water; improve public health; enhance education, and income generation.

The NEP outlines plans to expand clean energy to off-grid communities while avoiding GHG emissions from the use of fossil fuels such as diesel and kerosene. Using the NAMA Sustainable Development Tool, developed by UNDP, to guide the evaluation of these impacts against the Sustainable Development Goals (SDGs) agreed in 2015; development of mini grids for the poorest households will align with six of the following SDG markers⁹;

- SDG 1 – Poverty Reduction/Improved Livelihoods;
- SDG 3 – Improved indoor air quality/Improvement of health and health care conditions;
- SDG 4 – Better learning conditions/more education opportunities;
- SDG 5 – More jobs to women;
- SDG 7 – Improved Energy Security; and
- SDG 8 – Job creation

2.2. Industry Parks

In Ethiopia, the contribution of the industrial sector to GDP is still relatively small, although it has shown a slight increase from 11.5% in 2011/12 to 15.1% by the end of the first Growth and Transformation Plan (GTP I). However, this performance was short of the 19% target to be achieved by the end of the plan period. Part of the reason for this is that the contribution of the manufacturing sector to the overall GDP has remained below 5%, while the export contribution of the manufacturing sub-sector to total merchandize export has remained at about 10%, on average.

In the second Growth and Transformation Plan (GTP II) period 2015/16-2019/20¹⁰, the industrial value addition is set to increase at annual average growth rate of 20%, which would allow the share of the industry sector in overall GDP to increase from 15.1% in 2014/15 to 22.3% by 2019/20. Increasing the export share of manufacturing from its current level of 10% to 25% by 2020 and 40% by 2025 is viewed as a critical indicator of structural transformation. Export revenue from textile and garments, and leather and leather products will be an important component of the transformation as over 500,000 new jobs could be created.

To facilitate growth of the manufacturing sector, GoE is undertaking extensive development of industrial parks (over 15 expected to be completed by the end of the GTP II period), which according to government will be ‘world class sustainable eco-parks ready for plug and play’, with important incentives applicable to the investors in industrial parks¹¹. These parks will mainly attract investors in the textile and apparel, leather and leather products, pharmaceuticals, chemical industries, agro-processing,

⁹ *Off-Grid Rural Electrification in Ethiopia; NAMA developed with the Mitigation Momentum Project; MoWIE, SNV, Ecofys; 2016*

¹⁰ The GTP II development priorities over 2015–2020, include the following: (i) **Promoting the growth of the manufacturing sector** as part of a broader structural transformation process, and to move towards higher productivity and value added sectors; (ii) **Managing rapid urbanization** effectively, including the adequate provision of infrastructure and services, and support for the creation of urban jobs; and (iii) **Fostering low-carbon and climate resilient development**, as set out in the Climate Resilient Green Economy strategy (CRGE). Here it should be noted that Ethiopia ratified the Paris Climate Change Agreement in April 2017.

¹¹ <http://www.investethiopia.gov.et/investment-opportunities/strategic-sectors/industry-zone-development>



sugar and related industries, including the metal and engineering industries. Thus far, the operational industry parks are mainly focused on textile and apparel. One of the operational industrial parks, the Hawassa Eco-Industrial Park, is established with the aim of leapfrogging global competition by using the green identity of the park as a competitive advantage over rivals from Bangladesh and China.

However, a recent CDKN report by IPE Global, PwC and EDRI, shows that there is a 'dash for growth', which is clearly apparent in the industrialization strategy of the Government, a key and instrumental component of which is the industrial parks development programme. It is clear that these parks, which are run by the Federal Government Industrial Parks Development Corporation (IPDC), together with the more numerous regional, city and private industrial estate areas, have the potential to catalyse growth in cities, promote structural economic change, and create a significant number of jobs. However, these parks are also increasing the demand on, and competition for, infrastructure and resources such as power, water and transport, and, if poorly or inadequately managed, can place huge strains on an urbanizing economy including air and water pollution, traffic congestion and shortages of housing and other basic social services. This also includes higher GHG emission than was projected in the CRGE Strategy, which did not take into account such increased industrialization and the development of industry parks.

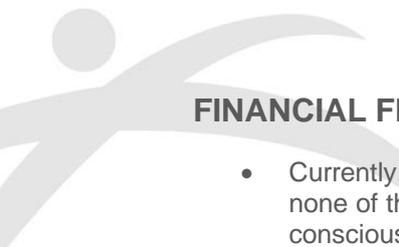
Hence, while the government continues to be proactive in developing/retrofitting 'hard' infrastructure solutions (such as the Zero Liquid Effluent Treatment Facility) to 'green' the industry parks, there remains relatively little action to put in place relatively 'softer; early planning and screening measures to ensure that investors coming into the industry parks are responsible and conscious 'green investors' thereby enabling the realization of the clean and green eco-friendly industrial development that the Government intends these parks to be.

To this end, there is a need to provide strategic advice and technical support to the Ethiopian Investment Commission which is responsible for attracting investment (particularly foreign investment) into Ethiopia's industrial parks. Such strategic technical support provides an important opportunity to bring green industrial development into mainstream consideration by influencing decisions on private sector investor attraction – both in terms of the investment attraction work that EIC undertakes outside of the Country and the domestic screening process that the EIC can potentially undertake to ensure that investors are environmentally and socially conscious and have a 'green' identity. The attracting of more green industries should not be seen as disincentivizing industries which are not green rather it could be an avenue to (a.) provide green industries with additional incentives stimulating their appetite to enter into industrial parks; and, (b.) promote behavioural changes in the industries which are less green.

Factors that influence the selection of industry parks as a sub-sector option are discussed below:

GHG ABATEMENT POTENTIAL / VULNERABILITY REDUCTION:

- The overall GHG mitigation potential in the industry sector is described in Ethiopia's CRGE Strategy and subsequent documents, including Ethiopia's NDC;
- However, as described above in its estimation of the total GHG emission in the industry sector, the CRGE Strategy did not take into account such increased industrialization and the development of industry parks. Hence there is a need to undertake work to estimate the increased GHG contributions of these industrial parks; and,
- Moreover, there needs to be an assessment of the opportunity cost of no action, namely of not undertaking early planning, guidance and screening process of investments coming into the industry parks to ensure that they are environmentally and socially conscious and have a 'green' identity. This can highlight the contribution that such early action can have on reducing vulnerability early enough prior to putting in place expensive retrofitted end of pipe treatment and infrastructure solutions.



FINANCIAL FEASIBILITY:

- Currently, while Ethiopia has stipulated important incentives to the investors in industrial parks¹², none of these incentives are specifically focused on encouraging environmentally and socially conscious investment and towards investors that have a green identity. To this end, incentives need to be mapped and refined to ensure that incentives are in line with the Government's vision of making these parks 'world class sustainable eco-parks ready for plug and play';
- In the long-term, these interventions needs a senior level well connected expert to be based within EIC to provide strategic advice and to advise on the incentive framework to attract conscious and green investment into the industry parks.

TECHNICAL FEASIBILITY:

- Such advisory support, is feasible if the right type of candidate is deployed to provide this advisory support;

CO-BENEFITS AND ALIGNMENT WITH OTHER DEVELOPMENT OBJECTIVES:

- There will be several co-benefits, including occupation health and safety, social and environmental benefits from putting in the instruments to bring in conscious, responsible and green investors into the industry parks.

2.3. Biogas

Given the significant contribution of the agriculture sector to emissions (40%), stimulating private sector involvement in the biogas market could be a potential opportunity to enhance climate mitigation. Based on a daily manure production from four cattle heads, domestic biogas can replace the equivalent consumption of five kilograms of firewood, 1.5 kg of charcoal or 0.6 l of kerosene per day. Most of the energy demand of rural communities in Ethiopia is met by wood biomass; this has resulted in a severe reduction in forest coverage over the past 35 years. The rates of the deforestation could mean a severe shortage of firewood availability in the future as well as the soil fertility, which may compromise food security. Considering the significant cattle farming undertaken within rural communities, the use of manure as an energy source could allow for deforestation to be curbed. Manure, in the form of dung cakes, possesses low conversion efficiency to heat (< 8%). Furthermore, if the conversion efficiency is too low, the use of manure could be used more appropriately for the fertilization of agricultural lands.

The use of animal waste for the production of domestic biogas can be more efficient alternative to the use of livestock manure with estimated conversion efficiencies of up to 55%. The domestic biogas policy landscape is well developed in Ethiopia. The Ethiopian government launched in the National Biogas Programme (NBPE) in 2008, which ran for five years until 2013. Initially, the NBPE planned to build 14 000 family sized biogas plants however, only 8063 biogas plants were built during this period (2480 in Oromia, 1992 Tigray and 1699 in Amhara). The second phase of the NBPE took place from 2014 to 2017 and aimed to construct 20 000 additional biogas plants. Currently, there are no available estimates for the actual number of biogas digesters, which have been implemented, in the 2nd phase of the NBPE. It is important to note that one of the goals of the Phase II of the NBPE was to involve the private sector to a greater degree, which aligns with the goals of the IKI MPI project.

Financial Feasibility – the Dutch SNV Development Organisation largely funds The NBPE. If biogas digesters were not donor-funded, it is unlikely that households and rural communities would be able to afford these systems. In comparison with other East African countries, biogas digesters cost approximately 3 cows as compared to 1.5 cows in Kenya and 2 cows in Tanzania. In the first phase of the NBPE, 43% of the actual implementation costs were covered by the subsidy. Taking into consideration that biogas digesters may not be useful in producing certain food types, the demand for biogas digesters may not be present even if they are more affordable to rural communities.

¹² These incentives might be calculated on an 'outcomes basis' where they are performance linked (an obvious measure would be CO₂, but might include an expanded matrix like green jobs, etc.). This may also provide additional motivation for the need for the candidate to provide these services.



Factors that influence the selection of biogas as a sub-sector option are discussed below:

BEHAVIOUR CHANGE:

The use of biogas is mainly as a cooking source as opposed to a lighting solution. At present, it is not possible to use biogas cookers for making of traditional food types such as injera. This is a staple food in Ethiopia, which is deeply rooted in the practices of rural communities. Therefore, behavioural change remains a significant barrier in stimulating the demand for biogas digesters.

GHG ABATEMENT POTENTIAL:

The abatement potential of biogas digesters in Ethiopia is relatively unknown. Even though bio-digesters have been installed in rural communities, their use within the household has not been assessed to a significant degree. Therefore, it is possible that firewood and charcoal may still be used even though bio-digesters are present.

TECHNICAL FEASIBILITY:

Agriculture waste, which is needed as a feedstock for bio-digesters, is readily available, as most rural communities possess livestock. Considering that 8063 bio-digesters were installed within the 1st phase of the NBPE, the energy solution is technically feasible.

Despite all indicators suggesting that biogas could be a potential market, there is still a preference for charcoal and firewood as a fuel type in rural communities owing to specific foods made. If 50-60% of domestic heating energy is used to bake injera then there will not really be a commercial market for biogas as it would be futile to build a smaller unit to cover the 40% non-injera related energy need.

Furthermore, access to credit services is a major inhibitor of biogas uptake from rural communities. Engaging micro financing institutions to offer microloans on favourable terms could allow for greater market penetration however, several commentators believe that charcoal and firewood will still be used even if bio-digesters are affordable.

2.4. Bioethanol

Forestry is the second largest contributor of GHG emissions in Ethiopia, with about one-third of the emissions attributable to deforestation and forest degradation (FDRE, 2017). As of November 2011, fuelwood accounted for more than 80% of energy supply in Ethiopian households, particularly in rural households. Projections indicate that unless action is taken to change the traditional development path, an area of 9 million hectares (ha) might be deforested between 2010 and 2030, while annual fuel-wood consumption would rise by 65% (FDRE, 2017).

The Climate-Resilient Green Growth (CRGE) initiative has prioritized two strategies that could help to develop sustainable forestry and reduce fuelwood demand:

- Reducing demand for fuelwood via the dissemination and usage of fuel-efficient stoves and/or alternative-fuel cooking and baking techniques (such as electric, LPG, or biogas stoves) leading to reduced forest degradation; and,
- Increase afforestation, reforestation, and forest management to increase carbon sequestration in forests and woodlands.

Introducing bioethanol as a domestic renewable cooking fuel meets the aim of reducing forest degradation through replacing biomass fuels such as charcoal and firewood and petroleum fuels. There are several benefits to replacing biomass fuels with bioethanol:

- Increased GHG sequestration in forestry due to a reduction in demand for fuel-wood;

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- Reduced the financial and foreign exchange risks to the economy's dependence on imports (replacing petroleum fuels e.g. kerosene), especially for a country in dire need of foreign exchange;
 - Improved health and financial savings by households substituting with bioethanol. Bioethanol is a cheaper cooking fuel compared to kerosene and LPG; it is slightly more expensive than biomass; and much more expensive than electricity due to the highly subsidized tariffs. Bioethanol may not be able to replace biomass use in rural areas as firewood and biomass in these areas are usually free. However, social valuation of ethanol and the alternatives makes bioethanol a cheaper cooking fuel compared to both petroleum and biomass fuels. The social value of bioethanol will not however influence the price;
 - Avoided energy-related deforestation through reduction in GHG; and,
 - Job creation through increased micro-distilleries in order to fill the demand- supply gap.

The Draft National Energy Policy (2013) of Ethiopia identifies ethanol as a domestic renewable fuel that will improve the security and reliability of energy supply for cooking. The second Growth and Transformation Plan (GTP II) also identifies bioethanol as an alternative to biomass fuels through supporting the construction of five bioethanol processing plants. The policy, however, refers large-scale plants rather than micro-distilleries which may inhibit the scaling up of the bioethanol sector¹³.

However, several challenges and barriers have limited scale-up of bioethanol as a cooking fuel in Ethiopia; and have been well documented in reports (FDRE, 2011; FDRE, 2017):

- The market for bioethanol is quite small in Ethiopia with limited private sector actors. At the same time, existing bioethanol distributors have very limited distribution capacity both financially (to purchase and distribute in significant volumes) and physically (storage and distribution facilities). As such, availability of bioethanol for cooking has been uncertain since the introduction of the fuel more than a decade ago. This has inhibited existing distributors from investing in distribution and also on marketing the fuel (which is also why the public is not aware of the existence of bioethanol as a potential alternative cooking fuel);
- Bioethanol pricing is in competition with wood, charcoal, kerosene, LPG and electricity. The price for ethanol has eroded its competitiveness with these fuels making it less attractive to consumers. For instance, the price of electricity is heavily subsidized and this may deter investors;
- Displacing firewood and charcoal is difficult within rural communities given the food types that are made. Above all, the price of bioethanol would be relatively high for rural households compared to the price of biomass fuels, which are either cheap or free. This creates barriers for the rural uptake of bioethanol, which in turn creates barriers for a sustained and thriving market;
- Alternative feedstock from sugarcane molasses that are viable in Ethiopia including sweet sorghum, sweet potato, sugar beet, cassava, prickly pear cactus, vegetable and fruit waste, have not been sufficiently explored as possible sources of ethanol production. Small and micro scale processing of feedstock with small and micro scale ethanol distilleries has also not been given sufficient attention in the past. Feedstock production and processing at small scale by private enterprises or cooperatives could supplement large-scale production and processing by the public sector; and,
- Inadequate support for functions in the supply chain including technology adaptation (distilleries, stoves), R&D for feedstock, standards and regulations for ethanol fuel and stove, financing of investment and R&D.

There is an opportunity for the market for bioethanol to thrive in Ethiopia if certain policy levers, institutional and regulatory frameworks are put in place, as suggested below:

¹³ <http://www.ena.gov.et/en/index.php/economy/item/3507-ethiopia-to-begin-construction-of-ethanol-production-plants>

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- There would have to be significant awareness and further research on the impact of bioethanol on food crop availability. Given the historical famine, the use of food crops for fuel production is a potentially sensitive topic;
 - Increasing bioethanol production from government sugar factories, through both government and private investment, will create competitive and stable prices for inputs (molasses purchases) and outputs (ethanol wholesale), which creates the potential to attract private investment;
 - Promoting diversity of bioethanol production feedstock (other than sugarcane molasses), will also diversify bioethanol production sources and attract investment;
 - Implementing social valuation of bioethanol, as a cooking fuel, in order to ensure that non-financial (health and environmental) benefits of bioethanol are captured in the price;
 - Providing tax exemptions for bioethanol if production costs exceed levels that make it competitive with other cooking fuels, especially if feedstock is imported;
 - Providing long-term outlook for price development for bioethanol to ensure sustained engagement of investors in ethanol distilleries and ethanol distribution; and,
 - Providing alternative distribution models for ethanol (bottled ethanol, ethanol at the petrol pump); and,
 - Pilot studies may need to be explored to determine the levels of market interest and potential.

3. Rationale for Selecting Sub-Sectors

To select between sub-sector opportunities within the energy sector, categories to mobilise private sector investment were evaluated within each option as shown in the Decision Matrix presented in Table 2 below. Some categories/considerations/questions are focused on their attributes and the subsequent relevance of the attributes to the project while some categories are consideration for the SSN team with regard to further implementation in the next phase of the project. The categories included in the decision matrix (Table 2) are:

- GHG reduction potential;
- Climate Resilience Building;
- Government/Political Buy-in;
- Enabling environment for the private sector;
- On the ground implementation of the policy frameworks;
- Building on an existing option/completely new option;
- Pro-poor solution;
- Quick win vs. longer term result;
- Potential for duplication;
- Significant barriers which could deter private sector engagement;
- Is the private sector interested in the sub-sector option;
- What is the potential to scale up the sub-sector option;
- What is the potential uptake by the end user; and,
- What is the ease of implementation?

Table 2: Decision Matrix for Identifying Sub-Sector Opportunities in Ethiopia

	Mini grids	Local Manufacturing	Building Entrepreneurship to access WB Funds	Biogas	Bioethanol	Greening Industry parks	Cookstoves
GHG reduction potential	High (displaces kerosene - it will have coverage)	High	High	High	High	Low (greening does not necessarily result in GHG reduction)	High
Climate resilience building	High	High	High	High	High	High	High
Government/political buy-in (recognition)	High	High (higher if export potential is considered)	High	High	Medium - not a CRGE priority	Very high	High
Enabling environment for the private sector	High (priviledges)	High (priviledges for manufacture)	High (WB identified this area as a gap to be addressed)	High (donor support to subsidize)	N/A	Very high	High (donor support to subsidize)
On the ground implementation of policy/enabling environment	Low	High		Medium (considering sustainability of donor support)	N/A	High	Medium (considering sustainability of donor support)
Building on existing or new	Exists + new IPP regulation	New - only assembly at this time	New (This is a niche area of work, focusing on supporting businesses access WB's USD 45 M for off-grid purposes)	Exists	New	Exists	Exists
Pro-poor solution	Very high	Medium	High (Establishing Businesses (Rural/Youth/Cooperatives), supporting them access to Funds, provision of Off-grid	High	Unknown	Medium-high	High
Quick win vs. Longer term result	Quick win (in relative terms)	Long-term	Quick win - Funds are available and WB keen to support entrepreneurs access these funds	Quick win	Long term	Quick win	Quick win

Table 2: Decision Matrix for Identifying Sub-Sector Opportunities in Ethiopia (Continued)

	Mini grids	Local Manufacturing	Building Entrepreneurship to access WB Funds	Biogas	Bioethanol	Greening Industry parks	Cookstoves
Potential for duplication	High	High	Medium - Some of the business established can potentially emerge in increasing their geographic reach	High	Low	High	High
are barriers identified and significant to deter engagement in this sub-sector	Identified and barriers are not as deterrent	Barriers not identified so risk	Medium - Barriers need to be identified on why the PS is not accessing these funds.	Identified and barriers are not as deterrent	Barriers not identified so risk	Identified and barriers are not as deterrent	Identified and barriers are not as deterrent
if there a need to build capacity to facilitate MPI?	High	High	High - WB targets first time businesses as opposed to established business to access	High	High	Medium	High
is the private sector interested?	High (one successful operator but interested ones in the pipeline)	Unknown	Low - Private sector is not applying to access the funds				
Potential to scale up	High - Assuming all enabling environments are available	High - Assuming all enabling environments are	High - this is the second tranche of funds made available by the WB,	Low - Expensive and applicability in the local context is low	Unknown	High	Unknown - business model is not clear
Uptake by end user	High	High	High	Low	Unknown	Unknown	Low - Highly subsidized
Ease of implementation (for the project group)	High	Low	High	Medium	Low	Medium	Low



The sections below provide a narrative for the rankings assigned to categories within Table 2 per sub-sector option.

Table 2: Rationale for Rankings Assigned to Categories per Sub-Sector

Sub-Sector	Description
Mini-grids	This sub-sector is ranked High as the NEP identifies it as one of the main instruments to deliver off-grid energy to 5.7 million rural households by 2025. The NEP empowers the private sector to deliver the off-grid targets. Furthermore, this initiative also contributes well to GHG reduction, and builds resilience within the communities. Albeit the private sectors' interest to invest in this sector, unclear policy and regulatory barriers have been acting as the main bottlenecks behind the proliferation of the private sector in this area.
Local Assembly/Manufacturing for export	This sub-sector is ranked Medium/Low. The main rationale for this sub-sector to be identified is to address the chronic FOREX issues that have been a challenge to import off-grid devices and meeting the NEP targets. The GoE provides incentives and benefits to attract FDI and local investment to local assembly and manufacturing to substitute imports and also encourage exports. However, various initial factors, including inland logistics and productivity issues have been highlighted as the deterrent factors to establish an assembly/manufacturing plant that can compete with global industries. Further, DfID has provided funds to assess the commercial viability and market requirements of local manufacturing, assembly, and supply chain for the off-grid lighting and electrification sector.
Building Entrepreneurship for WB Funds	This sub-sector has been identified as Medium/High. The WB has provided USD 45 million to the Development Bank of Ethiopia to be extended as a credit line to the private sector to be engaged in the provision of off-grid energy to the rural communities. The WB is keen to see an initiative developed to identify, incubate and scale up young entrepreneurs to access the fund. However, the WB being prescriptive on how the funds were to be used, which reportedly do not follow the existing market trend also signals the need to unpack this sub-sector a bit more before delving deeper.
Biogas	The sub-sector option is ranked Low/Medium. Despite the presence of high-level policy (National Biogas Programme), which has already installed over 8000 digesters, the success of these technologies, is limited its adoption at the household level. The cooking of traditional foods such as Injera is still preferred using wood fuel rather than biogas. Furthermore, the NBPE is still highly subsidized; it is questionable whether there is sufficient access to credit or indeed appetite for digesters without subsidies. The private sector has been limited in biogas up to this point. Given the barriers, it is unlikely to change without significant awareness raising and technology advancement.
Bio-ethanol	Given the numerous barriers to bio-ethanol as a fuel type, this sub-sector option is ranked as low. Bioethanol faces difficulty as it is in competition with fuels, which are significantly cheaper. Moreover, firewood is still the favoured option in Ethiopia, given its widespread availability. Lastly, the absence of developed supply chains requiring bio-ethanol and the presence of feedstock in-country makes it doubtful that the sub-sector will be viable in the short-term.
Greening Industry Parks	This sub-sector option is ranked Low/Medium. While this option is a high priority for the Government of Ethiopia and an area where government wants /anticipates a lot of private sector investment, it was observed that this option will not contribute to GHG reduction, particularly as these industrial parks will use energy from renewable sources.
Cookstoves	This sub-sector option is ranked Low/Medium. While efficient cookstoves can have substantial contribution to GHG reduction associated to the forest sector, it was observed that it was a lesser priority for government, e.g. in comparison to off-grid energy, and a working model does not exist for the private sector in Ethiopia in relation to cookstoves at present, as the sector is highly donor driven and subsidized.



4. Conclusion and Recommendations

From a sector perspective, energy still holds the greatest promise in mobilising private sector engagement and investment. The sector itself aligns well with Ethiopian development and climate policies, making it a suitable sector in the context of this study. After an initial review, the biogas, bioethanol, cookstoves and greening industry parks sub-sector opportunities were not considered, given their rankings.

The activities identified for the next phase of IKI MPI Ethiopia include:

ADDRESSING TARRIF RATE – CAPACITY ISSUES

- Building awareness and capacity on the types of Decentralized Renewable Energy Technologies - mini or micro grid technologies (i.e. solar, wind, battery bank, diesel and hybrid systems) to focused group of participants from the Ministry of Trade; MoWIE; Ethiopian Electric Authority (EEA); Ethiopian Electric Utility EEU); Revenue and Customs; Ethiopian Standards Authority. The form of this awareness could be workshops or the financing of internal personnel to build internal capacity for a given period;
- Showcasing how off-grid business are tarrified and classified in other countries. This activity can be in the form of a learning exchange or in the form of a commissioned report; this would have to focus on 'light-handed' regulation and Tanzania is arguably the leader in this regard.
- Provide technical assistance to the task force that has been established by the MoWIE to conduct a least cost tariff analysis to attract private sector investment in the off-grid areas. The form of capacity building envisaged would be through experts seconded within the MoWIE and providing hands on capacity to the task force; and,
- Providing technical assistance to the taskforce established by the MoWIE in designing the “off-grid implementation program” to roll out the National Electrification Program by beginning of 2019. The program targets providing lighting through off-grid sources to a total of 7.7 million households or to a population of 35 million by 2025.

ADDRESSING LICENSING – RULES AND PROCESSES FOR SMALL-SCALE ENERGY INSTALLATIONS

- Commissioning a study to develop a report that will identify the factors and recommendations to streamline the licensing and importing processes for businesses in the off-grid sector. The report shall:
 - Identify the current policy and regulatory frameworks within the off-grid sector including those that are being revised and in the pipeline to be endorsed;
 - Identify the bottle necks and propose suitable recommendations in the processes faced by the private sector between licensing and finally importing their off-grid product; and
 - Recommended off-grid licensing categories based on regional experience that will be applicable at the various levels of governance (Generation of off-grid power of 0 – 10KW could be approved at the Woreda; 11 – 100KW at the Zonal level; 100 – 1000KW at the Regional level and above 1MW at the federal level).

Attracting Investment for Mini-grids: Business models that could generate revenue from mini-grid solutions

- De-risking is a specific geographic off-grid area/s that have been identified as “High Priority” by the GoE for mini-grid development. This activity however is contingent upon the delivery of the “GIS least-cost rollout plan for grid and off-grid and high level investment financing prospectus;
- Programme expected to be delivered by end of 2018. Anchoring on the GIS result, the study will identify current/suppressed/future energy demands and will combine CAPEX and OPEX at selected high priority areas to identify small-scale businesses (Fishing/Agro-Systems/Household lighting/etc.) that are viable rural productive business to make mini-grids commercially viable to develop them;



- This business model developed shall serve as a derisking mechanism for the private sector to identify a viable business model within the off-grid sub-sector; a study upon which MFIs and the DBE can provide credit for the private sector to be engaged in the IPP business as well as to inform the REB's in outlining a viable mini-grid model upon which the NEP targets would be met; and
- Foundation to launching mini-grids pilot programme in Ethiopia where the government could be a partner in a donor funded programme. The programme would have to provide capital subsidies (grants) with a portion funded by project developers themselves. It is only within a programme framework (with GoE involvement), that the challenges may be addressed efficiently and effectively. Moreover, it is often that in business case development, pilots tend to reveal underlying challenges and the appropriate solutions.



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