Country	**Uganda**
Request ID#	**2016000048**
Title	Identifying barriers and providing operational recommendations for scale up the application of Pay As You Go mechanism for domestic PV systems in Uganda.
NDE	Maxwell Otim Onapa, Deputy Executive Secretary NDE Uganda, Uganda National Council for Science and Technology m.onapa@uncst.go.ug; maxwell.otim@gmail.com P. O. Box 6884 Kampala, Plot 6, Kimera Road, Ntinda Cell +256 772997450; office +256 705500 +256 4144 234579
Proponent	**Proponent 1: Fenix International** • Contact person: Caitlin Burton • Position: Director, Business Development • Email: cburton@fenixintl.com • Physical address: Plot 11 Wampewo Avenue, Kololo, Kampala, Uganda *About Fenix (source)* Founded in 2009, Fenix International is a venture-funded next-generation energy company with offices in East Africa and Silicon Valley. Their core expertise is in renewable energy, mobile finance, and last-mile sales, marketing, distribution and customer service. Fenix's mission is to empower their customers with life-changing energy technology and inclusive financial services. Fenix's main product is called ReadyPay. ReadyPay is a patent-pending financial platform that allows customers to pay-to-own Fenix solar energy systems over time. Engineered to integrate with any mobile money system, ReadyPay enables customers to make payments from a mobile phone and receive a secure code to unlock access to solar power until another payment is due. **Proponent 2: M-KOPA Solar** • Contact person: Monica Kavuma • Position: Finance Manager • Email: monica.kavuma@m-kopa.com • Physical address: Lubowa Estate,Plot 1300 – 1301, Kampala, Uganda *About M-KOPA (source)* M-Kopa helps low-income consumers acquire and own high quality, affordable energy solutions. M-KOPA has connected more than 500,000 homes in Kenya, Uganda and Tanzania to solar power with over 500 new homes added every day. **Proponent 3: Ministry of Energy and Mineral development (MEMD)** Mr. Wafula Wilson Ministry of Energy and Mineral development Renewable Energy Telephone: (256) 772867054 wafula@ energy.go.ug

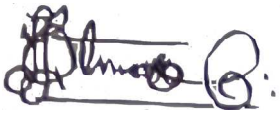
CLIMATE TECHNOLOGY CENTRE & NETWORK

Technical Assistance Response Plan – Terms of Reference

Summary of the CTCN technical assistance
The use of advanced mobile phone applications and innovative payment schemes has created a new market for the Pay As You Go (PAYG) mechanism supplying domestic solar PV systems in Africa. The mechanism eliminates the up-front investment cost for the end-user and allows payments to be made while using the solar PV equipment. The Pay As You Go mechanism and domestic solar PV systems are highly relevant for low-income household living in areas where no electricity grid is available. While the PAYG mechanism can trigger a number of climate and socio-economic benefits, there is still an un-tapped potential for the mechanism in Uganda. This technical assistance will analyse the main economic/financial, social, regulatory and technical barriers and provide operational recommendations on how to overcome these barriers.

Agreement:

(If possible, please use electronic signatures in Microsoft Word file format)

National Designated Entity to the UNFCCC Technology Mechanism
Name: Maxwell Otim Onapa
Title: Deputy Executive Secretary UNCST and National Designated Entity
Date: 10.October 2017
Signature: 

Proponent (signature of the Proponent is optional)
Name:
Title:

Date:
Signature:

UNFCCC Climate Technology Centre and Network (CTCN)

Name: Jukka Uosukainen
Title: CTCN Director
Date: 19 Oct 2017
Signature: 

1. Background and context

The Pay As You Go model

Advances in solar technology, applications for mobile phones and innovative financing schemes are accelerating access to energy for many poor and rural households. This is particularly true in sub-Saharan Africa where a wave of entrepreneurs is enabling access to electricity through off-grid domestic solar PV systems. Technology providers (like M-Kopa, Fenix International and others) supply small scale, domestic solar PV systems to off-grid households and only a minor financial deposit is paid at the initial stage by the customer. The majority of payments for the solar PV equipment are provided by the customer/user in instalments over a fixed time duration while the equipment is being used. Once the scheduled payments are completed, the customer owns the solar PV hardware. Payments are most often done via mobile phone banking applications using the GSM network. As a security mechanism, the technology supplier has the contractual right and technical capability to disable the functionality of the solar PV system in case the consumer defaults on the agreed payment scheme.

Such kind of technology and financial systems are generically termed "Pay As You Go" (PAYG) mechanisms. Purchasing of hardware using the PAYG mechanism is accelerating in many developing countries as the up-front investment costs for the hardware is reduced for the users. Consequently, the supplier of the hardware is carrying the majority of investment costs for the equipment. The mitigation of up-front investment costs for the user enables low-income households to purchase the solar PV system which they otherwise would not have been able to afford. Similarly, during the warranty period of the equipment, the technology and financial risks of the investment (i.e. dis-functioning of the equipment, high maintenance costs and level of electricity output) are carried by the technology suppliers and not the consumers. Over time, technology suppliers offering PAYG energy services can use custumers' payment history (proof of repayments) to offer concessional loans, or to finance additional assets, including advanced cook stoves.
This mechanism can also be scaled-up to larger energy systems that can potentially provide the electricity for all household energy needs.

Low-income households receiving access to modern energy solutions (solar PV and cook stoves) has a positive impact on socio-economic development among rural populations due to their very limited energy access rate. Similar, accelerated use of domestic solar PV systems and advanced cook stoves substitutes the use of electricity based on fossil fuels whereby GHG emissions are reduced and improving the air quality inside homes and thus diminishing relating health problems. By combining socio-economic development and climate change mitigation, the PAYG mechanism results in an attractive model for many developing countries.

The Pay As You Go market in East Africa

Off-grid solar technology providers are acquiring customers at impressive rates in Africa, as indicated by the customer numbers in Table 1[1]. Africa is a place where, for a huge proportion of the population, solar energy is now the cheapest option.

[1] IRENA, Renewable Energy and Jobs Annual Review 2016.
http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2016.pdf

TABLE 1: **EMPLOYMENT IN SELECTED OFF-GRID SOLAR COMPANIES - MID-2015**

Company Name	Full-time Employees	Countries / Regions of Operation	Number of Customers (Last 12 months / Cumulative)
Azuri Technologies	480	United Republic of Tanzania, Kenya, Uganda, Rwanda, Sierra Leone, Zambia	N.A. / 75,000
BBOXX	168	Rwanda, Kenya, Uganda	23,105 / 250,000
D. Light	>400	Uganda, Kenya, China, India	N.A./10 million
Fenix International	120	Uganda, Kenya	115,000 / 165,000
Foundation Rural Energy Services	342	Mali, South Africa, Burkina Faso, Uganda, Guinea Bissau	30,000 / 330,000
Grameen Shakti	6,550	Bangladesh	52,000 / 1.7 million
Mera Gao Power	125	India	8,000 / 22,000
M-KOPA	>700	Kenya, Uganda, United Republic of Tanzania	1.1 million / 3.75 million
Mobisol	>500	United Republic of Tanzania, Rwanda	70,000 / 110,000
Off Grid Electric	>800	United Republic of Tanzania, Rwanda	10,000 per month / N.A.
Renewable Energy Foundation	>400	Sub Saharan Africa	N.A. / >93,000
Simpa Networks	300	India	55,000 / 75,350
Solaraid	130	Kenya, Malawi, United Republic of Tanzania, Uganda, Zambia	519,212 / 10 million
Solar Kiosk	70	Ethiopia, Kenya, United Republic of Tanzania, Rwanda, Botswana, Ghana, Vietnam	802,500 / 1 million
Solar Now	194	Uganda	3,114 /8,476
Solar Sister	58	Nigeria, United Republic of Tanzania, Uganda	152,000 / 281,000
Sunlabob	42	Lao People's Democratic Republic, Cambodia, Uganda, Afghanistan, Sierra Leone, Mozambique and Liberia	N.A. / > 25,000
Tessa Power	300	Niger, Nigeria, Mali	2,000 / 5,000

Sources: Azuri (n.d.); D.Light (2016); Energy Access Practitioner Network (2015); Grameen Shakti (2016); IRENA (2012); Kent (2015); M-KOPA Solar (2015, 2016); Mobisol (2015); Nijland (2015); Sunlabob (2016); Wesoff (2015)

PAYG offerings are most common in Kenya, Tanzania, Rwanda and Uganda. These markets have a relatively large presence of off-grid solar products in general. But the market is mostly flourishing in Kenya.

Figure 35: Pay-as-you-go solar lighting services currently available (portable lights and solar home systems)

Source: Bloomberg New Energy Finance. Note: The list represents a sample and does not claim to be comprehensive.

M-KOPA Solar in Kenya, one of the best-funded start-ups in Africa according to Disrupt Africa's African Tech Start-ups Funding Report 2015, is an example of an OEC offering a range of products. These products are only available for households who have successfully completed the payment plan

on their solar home systems. The most popular first choice for low income consumers were improved cook-stoves[2].

In general, the solar PV market in Uganda has steadily grown over the last years with new stakeholders and market participants, including foreign investors, entering the market. Policy measures such as tax exemptions for the key components of the solar equipment (i.e. solar panels and batteries), and subsidies for end-users have also supported expansion of the sector. However, low-income households are not always benefiting from traditional large-scale solar PV systems, and market players have observed various financial, regulatory and technological barriers which hinder the further acceleration of the PAYG mechanism for domestic, small-scale solar PV systems in Uganda.

Preliminary identified barriers are described in the problem statement, section 2.

2. Problem statement

A total of 93% of rural households without access to electricity are currently using traditional lighting technologies such as candles or kerosene lamps that give poor quality lighting, emit noxious fumes and present hazards in terms of fires or burns. At the same time, households use biomass in a very inefficient way as the three-stone fire is still widely spread.

Source picture kerosene lamp[3], three-stone fire[4]

Compared to the traditional usage of kerosene lamps and open fire stoves, solar systems and clean cook stoves provide substantial benefits for the environment, reduction in GHG emissions, human health, children's education, and for woman, as further explained in footnote 2 and 3 and in attachment 1.

[2] Nitibhan.com. 2017. http://nitibhan.com/tag/pay-as-you-go-solar/

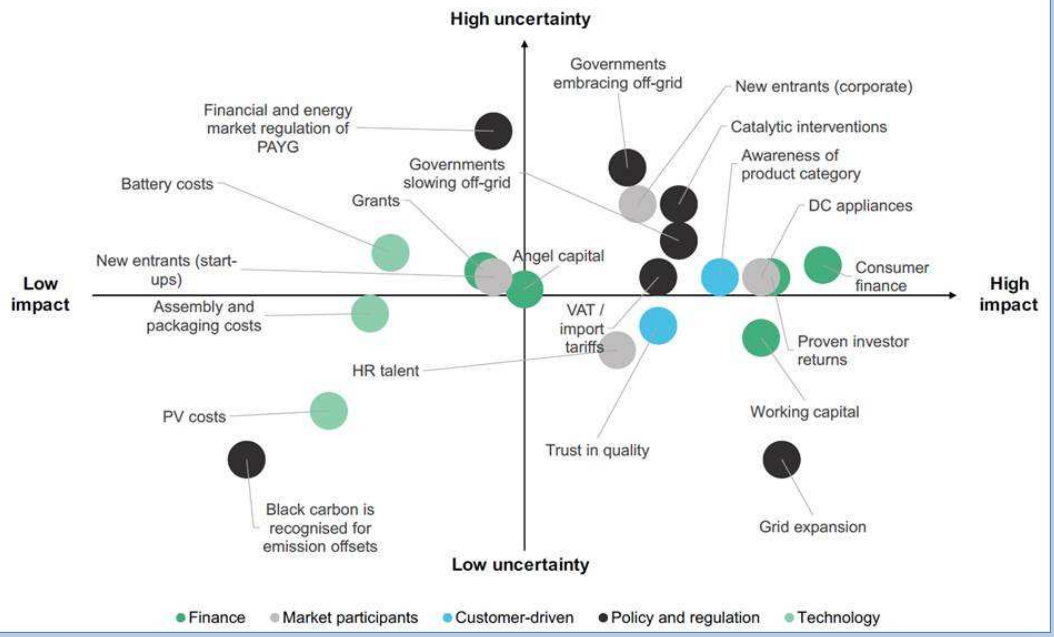
[3] African households spend as much as 30% of their income on fuel-based lighting. a costly and inefficient alternative. Fuel-based lighting is inefficient, provides limited and poor quality light, and exposes users to significant health and fire hazards (over 95% of fatal fire-related burns occur in low and middle-income countries), source

[4] A Ugandan woman lights a fire under a traditional three-stone fire. It is the cheapest stove to produce, requiring only three suitable stones of the same height on which a cooking pot can be balanced over a fire. Nearly two million people die each year as a result of inhaling lethal smoke from kitchen stoves and fires, source

Source picture solar light system,

The below graph shows a range of general variables and their relative impact and certainty for a range of OES, not limited to Uganda. Evidently, the OES officering PAYG services similar barriers and challenges which hinder the further use of small scale, domestic solar PV systems.

Figure 87: Impact and uncertainty matrix for off-grid solar market variables (subjective ranking by authors)



The PAYG mechanism has the potential to solve financial barriers of the end-user. Based on an interview with M-Kopa and Fenix International, the following preliminary barriers have been identified from the perspective of the technology supplier.

Financial/economic barriers:

- Technology providers face financial constraints on the upfront capital investments of the solar PV equipment. Costs of finance for pioneering energy solutions is high in Uganda and increased costs of investment capital adds to the overall risk profile of investment;
- Taxation schemes and import duties: the Government of Uganda previously provided favourable VAT and duty conditions for import and sale of solar PV systems. However, recently VAT and other duties have been re-introduced on the majority of spare parts used required solar PV assembling and maintenance including on the LED lights (only batteries and solar panels are still tax exempted). Re-introduced VAT and duties do add additional costs for the suppliers and consumers of the PAYG services for solar PV.
- Credit rating of customers: appropriate credit schemes facilitating the access to credit rating and mitigating the risk. PAYG suppliers in Uganda do not have access to a systematic credit rating scheme or database to assess the credit rating of the individual customer across the

various PAYG providers. The lack a of credit rating database entails that customers cannot demonstrate their credit history and the PAYG suppliers cannot assess the consumer's track record for providing timely payments from previously/other PAYG schemes. The lack of customer payment history adds a financial risk for the supplier and an additional cost for all PAYG customers. As an example, a Credit Reference Bureau for customers across various PAYG suppliers has been developed in Kenya. The bureau and access to consumer credit ratings have triggered lower prices and access to additional financial services for well-performing customers.

- Currency fluctuation: Suppliers of the PAYG services are exposed to fluctuations in currency rates as both USD and Ugandan shilling are involved in the investment flow. In fact, USD is typically applied to investments and some recurrent costs whereas Ugandan shilling is applied for local payments for the PAYGs services. Short to medium term fluctuations do compose a financial risk for the suppliers and it adds costs throughout the supply chain. The issue is further enforced due to the limited availability of local banks supply loans in Ugandan shilling.
- Tariffs: tariffs for electricity (calculated as a function of the total costs of the solar PV system against expected electricity output) and general consumer conditions for entering a PAYG contract are unregulated in Uganda. The unregulated PAYG market entails that various contractual conditions are offered to the market. As the general understanding of the PAYG mechanism is still at a pioneering stage in Uganda, consumers may consider some PAYG contracts as un-transparent.

Non-financial barriers:

- Regulatory environment: there are no Minimum Energy Performance Standards (MEPS) or other quality standards for solar PV equipment provided under the PAYG mechanism. The lack of standards entails that both low- and high-end quality products are being supplied. Low-end quality products will, everything else equal, have a shorter lifetime, lower electricity output and higher frequency of malfunctioning. Due to these conditions, low-quality products may be a barrier for creating trust and confidence in the PAYG services.
- Industrial association weakness: there is no sector association representing both national and international PAYG service providers in Uganda. The lack of a sector wide association makes it difficult for the sector to provide harmonized and uniform recommendations to the government on how to accelerate the PAYG services for solar PV systems.
- Legal framework: Enhancement of the legal and enabling environment for investors and technology suppliers are required to further accelerate PAYG mechanism in Uganda.
- Social awareness: information campaigns about the technical capabilities, usage, social, environmental and energy advantages of PAYG systems are necessary in order to raise awareness among people about their benefits and to avoid those systems being perceived as luxury goods.

Based on the above identified barriers and indirect collaboration key stakeholders, this technical assistance will strengthen the economic, financial and regulatory environment for PAYG services for solar PV systems in Uganda.

3. Logical Framework for the CTCN Technical Assistance:

(Guidance: Please note that multiple activities lead to one Output, and multiple Outputs lead to one Outcome. There can be several Outputs, but only one Outcome description capturing the CTCN technical assistance. Deliverables are the products or services to be delivered to the NDE/Proponent/CTCN based on the Activities and the Outputs.)

	1	2	3	4	5	6
Mandatory CTCN Activities i) A detailed work plan of all activities, deliveries, outputs, deadlines and responsible persons/organisations and detailed budget to implement the Response Plan. The detailed work plan and budget must be based directly on this Response Plan; ii) Based on the work plan, a monitoring and evaluation plan with specific, measurable, achievable, relevant, and time-bound indicators used to monitor and evaluate the timeliness and appropriateness of the implementation. The monitoring and evaluation plan should apply selected indicators from the Closure and Data Collection report template and enable the lead implementer to complete the CTCN Closure and Data collection report at the end of the assignment. iii) A two-page CTCN Impact Description formulated in the beginning of the technical assistance and updated/revised once the technical assistance is fully delivered (a template will be provided); iv) A Closure and Data Collection report completed at the end of the technical assistance (a template will be provided).	X					X
Mandatory Deliveries: i) Detailed work plan ii) Monitoring and evaluation plan iii) CTCN Impact Description iv) Closure and Data Collection report	X					X
Output 1: **A review of PAYG systems for domestic PV systems supplied in East Africa and identification of barriers for further acceleration of the PAYG mechanism in Uganda.**		X	X	X		

Activity 1.1: Review of PAYG systems and mechanisms for solar PV services provided in East Africa. Based on already available literature data and the interaction with proponents and local stakeholders, the review should include a mapping of all PAYG suppliers operating in East Africa, the scale and scope or their operations, products and conditions offered, areas covered, distribution model, partnerships, number of agents / employees and applied funding models; The review should also identify and assess any supporting mechanisms provided in East Africa for the PAYG systems for solar PVs. Supporting mechanisms may include subsidy schemes, concessional loans, favourable duty and tax conditions, etc. provided by governments or other actors.		X	X	X		
Activity 1.2: Building upon the barriers identified in the problem statement (but not limited to), a review and analysis of barriers hindering the further acceleration of the PAYG for solar PV services in Uganda is carried out. The analysis should group and analyse all barriers within the following categories: Economic and financial, social, regulatory and technical barriers. The barriers analysis should be done in direct collaboration with M-Kopa, Fenix International and Ministry of Energy and Mineral Development in Uganda.		X	X	X		
Activity 1.3: Local stakeholders meeting to present and consolidate key barriers in collaboration with stakeholders in Uganda. Targeted stakeholders should include both commercial and public entities and rural communities' representatives.		X	X	X		
Deliverable 1: Analytical report assessing PAYG systems, suppliers and supporting mechanisms in East Africa highlighting specific differences with the Ugandan case study. The report should furthermore include a detailed comparative analysis of the financial, social, regulatory and technical barriers hindering the acceleration of the PAYG mechanism in Uganda as findings of Activities 1.1, 1.2 and 1.3. Moreover the deliverable should summarise the outcomes of local stakeholder meeting (Activity 1.3) including a power point presentation given by the expert.				X		
Output 2: **Recommendations on how to overcome economic/financial, social, regulatory and technical barriers for the PAYG mechanism in Uganda.**				X	X	X
Activity 2.1: Based on the findings under Output 1, provide tangible and operational recommendations on how to overcome the identified barriers. Recommendations should be designed for both commercial actors providing PAYG services (M-Kopa, Fenix				X	X	X

International, and others), governmental entities (MEMD and others) and bilateral development partners in Uganda.						
Activity 2.2: As sub-set for the overall recommendations in Activity 2.1, the following operational recommendations should be provided: - In collaboration with M-Kopa and Fenix International, design of financial model for the PAYG service providers to overcome financial constraints on upfront investment capital, limited lending opportunities in local currency and fluctuations in currency rates; - In collaboration with MEMD, design a government support scheme to promote PAYG services for solar PV systems in Uganda. The support may include a subsidy scheme, concessional conditions on tax and duties, etc. - In collaboration with M-Kopa, Fenix International and relevant national authorities, design a systematic credit rating scheme to facilitate the credit access to customers and de-risk the suppliers investment (e.g. definition of credit schemes assessing customer's credit record); - In collaboration with M-Kopa, Fenix International and MEMD, design a MEPS scheme for the supplied solar PV equipment. - In collaboration with key stakeholders, provide recommendations on how to promote social awareness and sustainable development via the PAYG mechanism.				X	X	X
Activity 2.3: National workshop to present and consolidate the recommendations and operational designs as produced under Activity 2.1. and 2.2.				X	X	X
Activity 2.4: A gender mainstreaming assessment addressing relevant aspects of provided recommendations on the PAYG mechanism.				X	X	X
Deliverable 2: Analytical report presenting overall recommendations and operational designs for all activities performed under 2.1, 2.2 and 2.3.						X

** As mandatory deliverables for all CTCN Response Plans, the Lead Implementer must produce the following: i) A detailed work plan of all activities, deliveries, outputs, deadlines and responsible persons/organizations and detailed budget to implement the Response Plan. The detailed work plan and budget must be based directly on this Response Plan; ii) A monitoring and evaluation plan with specific, measurable, achievable, relevant, and time-bound indicators used to monitor and evaluate the timeliness and appropriateness of the implementation; iii) A two-page CTCN Impact Description formulated in the beginning of the technical assistance and update/revised once the technical assistance is fully delivered (a template will be provided). These deliverables must be included as initial items in the log frame.*

4. Resources required and itemized budget:

Please provide an indicative overview of the resources required and itemized budget required to implement the CTCN technical assistance, including for M&E-related activities, using the table below. Once the Response Plan is completed, a Response Implementation partner(s) will be selected by the Climate Technology Centre (CTC). A detailed activity-based budget for the CTCN assistance will be finalized by the CTCN and selected Implementer.

Activities and Outputs	**Input: Human Resources** *(Title, role, estimated number of days)*	**Input: Travel** *(Purpose, national vs. international, number of days)*	**Inputs: Meetings/events** *(Meeting title, number of participants, number of days)*	**Input: Equipment/Material** *(Item, purpose, buy/rent, quantity)*	**Estimated cost** *Please accumulate the costing at Activity and Output level and provide an estimated costing range for each activity and the total Response Plan*	
					Estimated range	
Mandatory activities	Energy Expert, 2 days Financial expert, 2 days	NA	NA	NA	$1,000	$3,000
A review of PAYG systems for domestic PV systems supplied in East Africa and identification of barriers for further acceleration of the PAYG mechanism in Uganda.	Energy Expert, 10 days Financial expert, 10 days	One 5-day mission to Kampala, Uganda	1 stakeholder consultation meeting	Meeting venue	$15,000	$17,000
Output 2: Recommendations on how to overcome economical/financial,	Energy Expert, 30 days Financial expert, 30	One 5-day mission to Kampala, Uganda	1 stakeholder workshop	Meeting venue	$60,000	$70,000

social, regulatory and technical barriers for the PAYG mechanism in Uganda including a gender mainstreaming assessment.	days Gender expert, 3 days					
Estimated range of costing for the entire Response Plan					$76,000	$90,000

5. Profile and experience of experts

Based on the required Human Resources identified in section 4 (Resources required and itemized budget) please provide a description of the required profile of all involved experts for the implementation of the CTCN Response Plan.

Experts required	Brief description of required profile
Energy expert	• *10 years of experience and expertise within solar PV technologies, in particular small scale domestic solar PV systems for off-grid areas;* • *10 years of experience and expertise from East Africa, preferably from Uganda;* • *Experience in assessing financial and regulatory schemes promoting the use of the renewable energy solutions at household level in Africa;* • *Experience in working with national authorities and the private sector for formulation of government support schemes for off-grid renewable energy solutions.*
Financial expert	• *10 years of experience and expertise working with financial topics in the context of renewable energy;* • *10 years of experience and expertise from East Africa, preferably from Uganda;* • *Experience in assessing financial and regulatory schemes promoting the use of the renewable energy solutions at household level in Africa;* • *Experience in working with national authorities and the private sector in formulating government support schemes for off-grid renewable energy solutions;* • *Experience working with the private sector on financial business models for renewable energy solutions;* • *Experience working with customer financial ratings and financial rating schemes.*
Gender expert	• *Comprehensive experience working with gender mainstreaming assessments in development and energy related*

	programmes; • *10 years of experience and expertise from East Africa, preferably from Uganda;*

6. Intended contribution to impact over time

Direct impact:
From initial research, the following numbers have been calculated for the poorest people, living at the 'Bottom of the Pyramid' (BoP):

- Calculated population reached through PAYG systems, as a percentage of the poorest families: 7% in Uganda. Still to reach: 17,8 million people (93% within BoP)

As per M-Kopa's calculation, 0.092 tonnes GHG emission reduction per year per lamp can be achieved. Thus if a product has 4 lamps (torch included) it can claim 0.368 tonnes of displaced CO2 per year. In the current baseline condition, M-Kopa has reached app. 500,000 households, all using a domestic solar PV system. The CO2 reduction of M-Kopa currently market can be estimated to 184,000 tons CO2 per year. The prospects for further CO2 reductions are thereby significant if conditions for the PAYG mechanism is improved.

This counts for the solar device, which replaces a kerosene lamp. The potentially much larger impact of advanced cook stoves, replacing a three-stone fires, have not been included yet and depends on the amount of households reached.

Indirect impact:
Over 90% of the rural population in Uganda lacks access to clean and affordable power. In addition, the vast majority of these households cook on wood fuels (wood/charcoal). Lack of access to clean power and affordable improved cook stoves has a large negative impact in relation to climate change. One should think of:

- Deforestation[5]
- Product of incomplete combustion from inefficient stoves and kerosene lamps
- Usage of off-grid, domestic diesel generators[6]

If barriers would be removed and the scale up and diversification of off-grid energy companies (OECs) would not be constrained anymore, obviously more rural household will get faster access to solar energy and clean cook stoves.

Attachment 1 provides additional information on the negative impact of energy poverty on climate change in Uganda. Besides these, the issue of energy poverty in general hinders economic growth, social development, education and spending power. Using the traditional kerosene lamps and low-performing cook stoves has a large negative impact on people's health. Last but not least, more people will work within this potentially fast growing sector.

7. Relevance to NDCs and other national priorities

Uganda's Nationally Intended Contributions describes the development of the electricity sector and promotion and wider solar uptake of solar energy systems as key mitigation targets for the country. This technical assistance contributes directly to these national targets and priorities.

Uganda describes its energy action agenda towards 2030 in the SE4ALL: Sustainable Energy for All:

[5] Forests play a huge role in the carbon cycle on our planet. When forests are cut down, not only does carbon absorption cease, but also the carbon stored in the trees is released into the atmosphere as CO2 if the wood is burned or even if it is left to rot after the deforestation process.
[6] As an example, in Nigeria, diesel emissions from domestic generators surpass those from workplaces, trucks, and buses, and pose greater risks to human health and the environment due to proximity to homes and prolonged duration of use.

- Access to modern and clean energy services is a necessary precondition for achieving development goals that extend far beyond the energy sector, such as poverty eradication, improved public health and education.
- Energy access: 15% of the population has access to grid services, out of which 7% in rural areas. Taking into account ongoing projects and existing plans to enhance access to electricity, new interventions are suggested targeting about 3.17 million households with off-grid solutions. Off-grid solutions include solar home systems for households living under the poverty line.
- Cooking energy: in 2012, only 500,000 households (7% of the population) were using clean and efficient cookstoves. The major existing plan is to provide 5 million new households with clean and efficient stoves by 2020; reaching by then 64% of the projected population. To target universal access by 2030 several additional interventions are needed, including providing 5.4 million households with improved wood and charcoal stoves by 2030.
- Clean cooking: Developing better and innovative improved cookstove technologies, providing a longer lifespan; Promoting international affordable standards and rigorous testing protocols and enhancing monitoring and evaluation; Supporting the Green charcoal Initiative, and dissemination of alternative viable fuels (LPG, ethanol,etc.).

8. Linkages to relevant parallel on-going activities:

The following initiative can benefit from the activities of CTCN technical assistance:
'FRES (Foundation Rural Energy Services) promotes rural electrification for socio-economic development in rural communities of developing Sub-Saharan Africa, by establishing local commercial companies that provide affordable and reliable access to electricity services to rural off-grid communities. The core business of FRES companies in Africa is selling electricity as a service, from a Solar Home System (SHS) via a fee-for-service business model. FRES is starting the following study:

Objective: identify suitable service provider systems and the willingness to pay of customers. These are distinctly different stakeholders, requiring different approaches.
1. Define what service FRES needs from a service provider at which conditions (cost, admin etc)
2. Develop a picture of the service possibilities; existing and future, and assess he attractiveness for FRES customers'

More indirectly, this TA could assist two programs that are currently running in Uganda
1. Africa Community Centre for Social Sustainability (ACCESS) under which the Uganda Government together with the World Bank is supporting two improved cook stove projects, one related to willingness to pay and one related to distribution models.
2. United Nations Development Program that in cooperation with MEMD is carrying out a study called "Addressing Barriers to Adoption of Improved Charcoal Production Technologies and Sustainable Land Practices through an Integrated Approach ("Green Charcoal Project")"

9. Anticipated follow up activities after this technical assistance is completed:

The local NDE, MEMD, M-Kopa and Fenix International will be the main target group and receivers of this technical assistance. These stakeholders will be able to take the recommendations forward and apply the operational guidance in their various work streams.

10. Gender and co-benefits:

Imbedded in design of the activities:	*A gender mainstreaming analysis is mandatory to include for all technical assistances. A gender expert will be assigned to carry out an assessment and evaluation regarding gender mainstreaming during the implementation of the*

	TA.
Gender and co-benefits intended as result of the activities:	*The results of this Response Plan will include a number of gender and co-benefits. These include:* • Health benefits, especially with clean cook stoves, but as well reduced use of kerosene for lighting options; • With the application of energy efficient electrical cook stoves as part of the PAYG services, households no longer spend time on gathering pieces of wood fuel for cooking; • Low-income households will gain access to modern solar PV systems will allow them to charge their mobile phones. The access and utility of mobile phones do allow household to engage in activities contributing to the socio-economic development;

11. Main in-country stakeholders in implementation of the technical assistance activities:

Using the table below, please list and describe the role of in-country stakeholders, participants and beneficiaries who will be involved in or directly consulted during implementation of the assistance.

In country stakeholder	Role in implementation of the technical assistance
National Designated Entity. Uganda National Council for Science and Technology	International co-ordination with CTCN network. Regional co-ordination with other NDEs. National coordination with line ministries, institutions and other stakeholders.
Ministry of Energy and Mineral development	Provide information on the current applications PAYG mechanism for solar PV, provide information on regulatory and institutional matters, direct collaboration for the design of government support scheme and customer credit rating scheme for the PAYG mechanism.
M-Kopa and Fenix International	Provide information on the PAYG market in Uganda, applied technologies, key barriers, etc. Direct collaboration for the design of all relevant recommendations produced as part of this technical assistance.
Financial institutes	Input to the project: existing systems, data collection, experiences, barriers, etc.

12. SDG Contributions:

*Instructions: Please complete the grey section below for **a maximum of three SDGs** that will be advanced through this TA. A complete list of SDGs and their targets is available here: https://sustainabledevelopment.un.org/partnership/register/.*

Goal	Sustainable Development Goal	Direct contribution from CTCN TA (1 sentence for top 1-3 SDGs)

1	End poverty in all its forms everywhere	
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	
3	Ensure healthy lives and promote well-being for all at all ages	
4	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	
5	Achieve gender equality and empower all women and girls	
6	Ensure availability and sustainable management of water and sanitation for all	
7	Ensure access to affordable, reliable, sustainable, and modern energy for all (consider adding targets for 7)	
	7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services	This technical assistance will support the further acceleration of the PAYG mechanism providing domestic solar PV systems to low-income households. The application of modern solar PV equipment will contribute to Sustainable Development goal 7.1.
	7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix	This technical assistance will support the further acceleration of the PAYG mechanism providing domestic solar PV systems to low-income households. The application of modern solar PV equipment will provide renewable energy and thereby contribute to Sustainable Development goal 7.2.
	7.3 - By 2030, double the global rate of improvement in energy efficiency	
	7.a - By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	
	7.b - By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support	
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	
10	Reduce inequality within and among countries	
11	Make cities and human settlements inclusive, safe, resilient and sustainable	
12	Ensure sustainable consumption and production patterns	
13	Take urgent action to combat climate change and its impacts	The acceleration of domestic solar PV systems will replace the use of fossil fuels and thereby contribute

		to climate change mitigation.
	13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	
	13.2 - Integrate climate change measures into national policies, strategies and planning	
	13.3 - Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	The formulation of a government support scheme promoting the PAYG mechanism will improve Uganda's institutional capacity.
	13.a - Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	
	13.b - Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development	

13. Classification of technical assistance:

Please indicate primary type of technical assistance. Optional: If desired, indicate secondary type of technical assistance.

Please tick off the relevant boxes below	*Primary*	*Secondary*
☐ 1. Technology identification and prioritisation	☐	☒
☐ 2. Research and development of new climate technologies	☐	☐
☐ 3A. Feasibility studies for specific known climate technology options	☐	☐
☐ 3B. Piloting of known technologies in local conditions	☐	☐
☐ 4A. Law, policy and regulatory reform recommendations	☐	☐
☐ 4B. Sector specific roadmap or strategy design	☐	☐
☐ 5. Finance facilitation and market creation	☒	☐

Please note that all CTCN technical assistance contributes to strengthening the capacity of in country actors.

14. Monitoring and Evaluation process

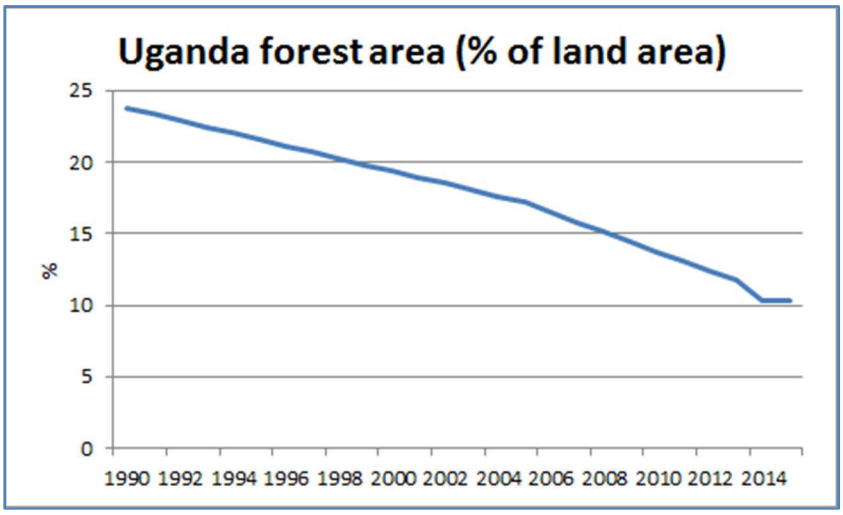
Upon contracting of the implementing partners to implement this Response Plan, the lead implementer will produce a monitoring and evaluation plan for the technical assistance. The monitoring and evaluation plan must include specific, measurable, achievable, relevant, and time-bound indicators that will be used to monitor and evaluate the timeliness and appropriateness of the implementation. The CTCN Technology Manager responsible for the technical assistance will monitor the timeliness and appropriateness of the Response Plan implementation. Upon completion of all activities and outputs, evaluation forms will be completed by the (i) NDE about overall satisfaction level with the technical assistance service provided; (ii) the Lead Implementer about the knowledge

and learning gained through delivery of technical assistance; and (iii) the CTCN Director about timeliness and appropriateness of the delivery of the activities and outputs.

Attachment 1: additional information negative impact of energy poverty in Uganda

Cooking; deforestation

Wood fuels are largely used for cooking in rural areas while charcoal mostly provides for the cooking needs of the urban population. High demand for wood fuels used inefficiently results in overuse and depletion of forests, as shown by the below figure (source).



The land available is becoming scarce and households prefer to use the land for food crops rather than planting trees. In addition, illegal cutting of trees increases. Since 1990 the forested area decreased from 49,240 km² down to 29,880 km². This means that from 1990 until 2010 more than 19,360 km², equaling 39 % of the existing forest disappeared. Currently about 90,000 hectares (equals 900 km²) of forest cover are lost annually, which leads to fuel wood scarcity in rural areas and increasing price levels of charcoal and fuel wood.

Urban and rural households are facing increasing energy costs or spend more time collecting firewood. Furthermore, the traditional use of firewood is responsible for high indoor air pollution levels, thus causing respiratory diseases that affect women and children in particular. Moreover, the latter spend many hours and travel long distances to collect fuel wood. This deprives women of valuable time to engage in income generating activities and children to go to school and study.

Cooking[7]; charcoal

Between 2005 and 2008 the charcoal price rose at an enormous nominal rate of 14% per year. The production of charcoal is carried out under primitive conditions with an extremely low efficiency at 10 to 12% on weight-out to weigh-in basis and an efficiency rate on calorific value basis at 22%. Production of charcoal also results in illegal logging; hence further increasing deforestation levels.

Cooking; stoves

At the same time, households use biomass in a very inefficient way as the three-stone fire is still widely spread. Using efficient cook stoves would save women time during cooking.

[7] http://www.illegal-logging.info/regions/uganda

No access to electricity: lighting and kerosene lamps

A total of 93% of rural households without access to electricity are currently using traditional lighting technologies such as candles or kerosene lamps that give poor quality lighting, emit noxious fumes (black carbon) and present hazards in terms of fires or burns (in particular for small children).

No access to electricity: larger applications and diesel generators

Furthermore, the majority of social institutions (e.g. schools and health centres) in rural areas do not have access to electricity, which leads to inferior health and education services in comparison to electrified institutions. Lack of access to electricity also severely constrains the economic development of rural areas of Uganda, preventing the establishment of businesses that require electric power or forcing companies to buy diesel or petrol generators that are costly to operate and negatively impact the environment. Furthermore, job creation is being seriously constrained by the lack of adequate investment in the provision of rural infrastructure services, of which electricity is a key component. Lack of electricity also prevents access to information and communication technologies (e.g. mobile phones, computers, internet). This contributes to further isolation of rural areas from the rest of the country. Further, the quality of rural life is hampered by lack of electricity, particularly as rural public institutions such as health, educational and water facilities would be able to provide better services if they had access to electricity.

Focus:	Problems:
Light: solar systems compared to kerosene lamps	Kerosene lamps: -GHG emissions (environment, country) -Black carbon emissions (environment, country) -Smoke inhaling (health, medical costs) -Fire risk: injury and death (health, medical costs) -Fire risk: loss of property (household) Solar systems: -Investement costs (households and trade)
Cooking: improved stoves compared to original stoves	Original stove: -GHG emissions (environment, country) -Black carbon emissions (environment, country) -Smoke inhaling (health, medical costs) -Fire risk: injury and death (health, medical costs) -Fire risk: loss of property (household) -Fuel costs (households) Improved stove: -Investment costs (households and trade) -Availability fuel (household)