FISCAL POLICY ANALYSIS

An assessment of the tax and subsidy options to accelerate solar home systems in Uganda

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Uganda Off-Grid Energy Market Accelerator

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ACRONYMS AND ABBREVIATIONS

BoP	Base/Bottom of the Pyramid
DFID	Department for International Development
ECA	Economic Consulting Associates
ERA	Electricity Regulatory Authority
ERT	Energy for Rural Transformation
ESMAP	Energy Sector Management Assistance Program
MEMD	Ministry of Energy & Mineral Development
NEP	National Energy Policy
NPA	National Planning Authority
OGE	Off-Grid Energy
PAYG	Pay-as-you-Go
RBF	Result Based Financing
RE	Renewable Energy
REA	Rural Electrification Agency
REP	Renewable Energy Policy
RESP	Rural Electrification Strategy and Plan
SE4All	Sustainable Energy for All
SHS	Solar Home Systems
SSMP	Sustainable Solar Market Packages
TA	Technical Assistance
UNBS	Uganda National Bureau of Standards
UNCDF	United Nations Capital Development Fund
URA	Uganda Revenue Authority
USAID	United States Agency for International Development
USD	United States Dollar
W	Watt
Wh	Watt-hour

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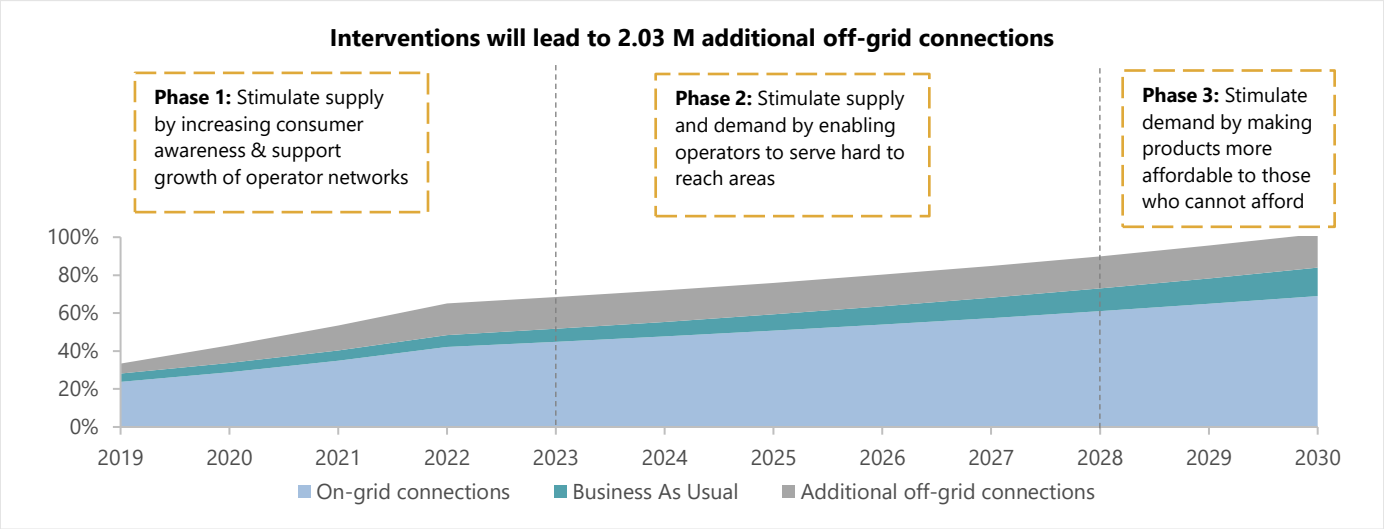
EXECUTIVE SUMMARY

The Uganda Off-Grid Energy Market Accelerator (UOMA) conducted a cost-benefit analysis of the impact of various tax and subsidies policies on the uptake of solar home systems (SHS) – both 'plug-and-play' and 'component-based' – in Uganda. This study explored the levers of VAT and import duties as well as the complementary value of subsidies, both market, and consumer-facing, to accelerate current SHS growth rates, to move the country towards universal access to electricity.

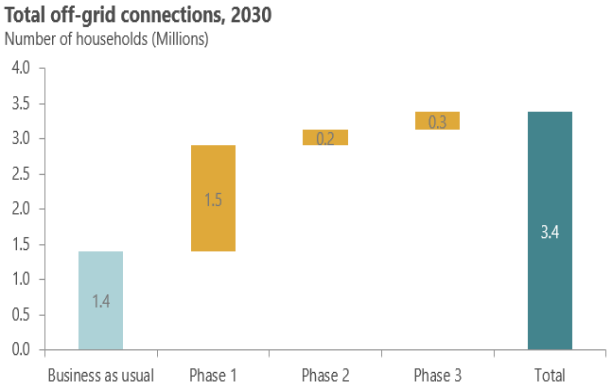
Our analysis recommends phasing subsidy interventions to both meet access targets and minimize market distortion while maintaining the current tax regime.



Tax options: The current tax regime with complete exemption on solar generation will enable growth in total SHS connections to 2.03 M by 2030. From this analysis, it remains optimal to maintain the current tax regime and focus on improving its implementation mechanisms.

Subsidies: Our analysis recommends phasing subsidy interventions phased to minimize distortion by supporting operators first and then subsequently providing support for end users who cannot afford the products at market rates

- ***Phase 1 (USD 54 M):*** Working capital financing facility to support business to finance inventory carrying costs for products offered to customers on flexible payment terms; and subsidy to incentivize the cost to serve hard to reach regions
- ***Phase 2(USD 4.1 M):*** Risk sharing instruments like guarantees, incentives for operators to serve hard to reach areas and a consumer financing facility
- ***Phase 3 (USD 3.7 M):*** Consumer interventions for affordability – consumer financing and direct subsidies to end consumers



INTRODUCTION

Background

DFID's Energy Africa campaign engaged the Uganda Off-Grid Energy Market Accelerator (UOMA), led by Open Capital Advisors (OCA), and Economic Consulting Associates (ECA) to conduct an analysis of the various fiscal policy options available to accelerate the market for Solar Home Systems (SHS) in Uganda.

In 2014, around 80% of Uganda's population, or approximately 30.9 million people, lacked access to the grid network, and in rural areas, the electrification rate was as low as 10%. From the government's master planning exercise, grid extension is often not a financially viable option for areas sparsely populated or hard to reach. In this context, off-grid energy solutions, like solar home systems (SHS), offer significant potential for the electrification of rural areas in Uganda. Despite this, the market remains largely untapped, with only about 300,000 households in 2017 connected to a minimum Tier 1 solar home system.[1]

The Government of Uganda, in the 10-year Rural Electrification Strategy and Plan (RESP) 2013-2022, set a target to increase access to electricity in rural areas to 26% by 2022. This includes increasing the number of off-grid connections by 138,500 with over 95% expected to be solar home system installations. Further, in order to reach its electrification goals, the Rural Electrification Agency (REA) has now commissioned the development of the Off-Grid Strategy to serve as an addendum to the RESP. This strategy will be presented to Cabinet, highlighting the significant role that off-grid energy will play in the short-to-medium term to ensure that Uganda meets universal access by 2030.[2]

The objective of this report is to provide recommendations for the government on how fiscal policy can be utilized to meet the targets and plans highlighted in the Off-Grid Strategy. This report analyzes the current policies, evaluates global practices, conducts a cost-benefit analysis, and makes recommendations to inform the decision-making process of policymakers in Uganda.

Off-Grid Energy in Uganda

With the annual population growth projected at 3% per annum, expanding from just under 8 million households in 2016 to over 12 million households in 2030, the Ugandan energy market needs to connect over 9 million unserved households by 2030 to achieve universal energy access.[3]

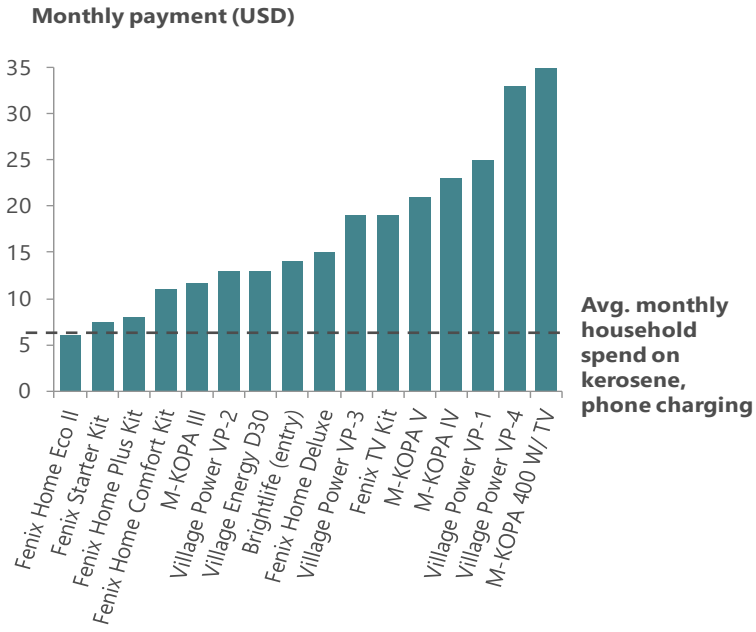
Several government efforts are underway, including the new 'Free Connection Policy', and the national grid is expected to grow considerably in the coming years, reaching 3 million new customers by 2027.[4] However, despite these efforts, the physical expanse of the country and the prevalence of rural, low-density communities means the central grid is unlikely to reach a substantial proportion of the population. Current government estimates highlight that over 30% of the population is unlikely to be reached for the next several decades.[5]

Unlike central grid extension programs managed by the government, off-grid solar, led predominantly by private sector solar home system (SHS) companies, has been able to serve unconnected rural households more efficiently.[6] Private sector operators today provide a range of commercial solutions to off-grid customers, spanning low-capacity solar lanterns, to

[1] UOMA (Uganda Off-Grid Market Accelerator). 2018. Uganda Off-Grid Market Map. UK London: The Shell Foundation.
[2] Draft Uganda Off-Grid Strategy for Stand Alone Solar Systems and Mini-Grids prepared by NRECA International for USAID – Uganda Electrification Expansion and Improvement Program Cooperative Agreement No. AID-OAA-A10-00028, April 2018
3 Uganda's SE4ALL Action Agenda (2015)
4 Rural Electrification Agency statement at East Africa Energy and Infrastructure Summit (2018)
[5] Rural Electrification Agency, Draft Off-Grid Strategy (June 2018)
[6] Uganda's SE4All Action Agenda (2015)

large mini-grid systems. The most common offering in today's market is the SHS, a system of solar panels that offer households between two and five lights, phone charging, and a radio. A typical unit starts at approximately USD 100, a considerable cost in a country where over half the population lives on less than USD3 per day. To counter this constraint, many SHS companies offer Pay-As-You-Go (PAYG) technologies that allow households to pay for products in flexible installments, based on usage. Figure 1 below shows monthly payments for select products, compared with monthly spend on kerosene lighting and phone charging.

Figure 1: PAYGO monthly payments vs. average monthly energy spend[7]



Despite the many efforts of government and donor agencies to support the off-grid solar market in Uganda, it is forecasted that by 2030 Uganda will not be able to close the gap between the large potential demand in rural areas and the supply of household solar products.

Several factors are holding back the market expansion to rural areas, including high upfront investment costs, low payment capacity of potential clients, and insufficient financing. While there are several options for supporting the expansion of the off-grid solar market, this report explores the fiscal options of intervention to accelerate the industry.

[7] Uganda Off-Grid Market Map (UOMA, 2018)

ANALYSIS OF FISCAL POLICY OPTIONS

The objective of this analysis is to provide the government with recommendations on how fiscal policies can be utilized to meet the targets and plans highlighted in the REA Off-Grid Strategy. The recommendations are a result of a cost-benefit analysis by UOMA, through a combination of interviews, literature review, desk research and extensive consultations with various stakeholders outlined in the methodology below.

METHODOLOGY

The analysis for this report was conducted in four major steps – data collection, data analysis, data validation and final publication as seen in Figure 2 below.

Figure 2: Methodology

i. ***Data collection:*** The research team carried out 20 interviews and reviewed government reports and policies to prepare a literature review and situational analysis of the various fiscal policy options available for supporting solar home systems in Uganda. The results of these were shared in a separate report.[8]
ii. ***Data analysis:*** The team subsequently conducted a detailed cost-benefit analysis to review and assess the fiscal policy options to support SHS in Uganda. This analysis relied on the data collected from the interviews and additional desk research on current fiscal policy efforts both in Uganda and globally.
iii. ***Data validation:*** The team consulted with over 20 stakeholders constituting a mix of government, private sector operators, development partners, funders and industry associations. The goal of the consultations was to review the results of the analysis and sense check Uganda market assumptions. The feedback from the consultations has been incorporated in this report.
iv. ***Report publication:*** This report, henceforth, is a culmination of the interviews, research, and findings from the analysis after extensive review from key stakeholders (mentioned in the *Acknowledgments section* of this document).

ASSUMPTIONS

To assess the implications of the various fiscal policy options, we developed a projection model looking at the current growth trajectory in off-grid connections, and testing scenarios around taxes, subsidies and their combined influence on the uptake of SHSs. This model makes the following key assumptions:[9]

1. Energy sources and targets:

According to the draft Off-Grid Strategy analysis, the current government rural electrification program is on track to meet the RESP II 2022 targets of 26% rural access and 42% grid access. Despite this trajectory and further investment in grid extension, there will be a 31% shortfall for universal access by 2030 which can only be served by off-grid solutions.[10] This

[8] ECA analysis of Off-Grid Energy policy in Uganda
[9] (Detailed assumptions included in the *Appendix section* of this document)

[10] Draft Uganda Off-Grid Strategy for Stand Alone Solar Systems and Mini-Grids prepared by NRECA International for USAID – Uganda Electrification Expansion and Improvement Program Cooperative Agreement No. AID-OAA-A10-00028, April 2018

report looks at why solar home systems are the best off-grid solution available to meet this shortfall and the options available to accelerate the sector.

2. Minimum level of service:

In line with the draft Off-Grid Strategy, this report relies on the Multi-Tier Framework, seen in Figure 3, developed for ESMAP under the SE4ALL initiative to define access as differentiated levels of service based on quality, quantity, reliability, and other key metrics. The analysis here, considers the minimum level of service as an "enhanced" Tier 1 multilight point system with 12Wh of light output capable of delivering four hours of energy services per 24-hour period and charging a phone or radio. This level of service was agreed upon by several stakeholders consulted by the Government of Uganda in preparation for the draft Off-Grid Strategy document.

In addition, the analysis only focuses on energy use at the household level, even though the Multi-Tier Framework is agnostic to technology types that are applicable for households or institutions (such as clinics and schools).

Figure 3: Multi-Tier Framework for Access to Household Electricity Supply[11]

Attributes		Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Capacity	Power		Min 3W	Min 50W	Min 200W	Min 800W	Min 2kW
	Daily capacity		Min 12Wh	Min 200Wh	Min 1.0kWh	Min 3.4kWh	Min 8.2kWh
Duration	Hours per day		Min 4 hrs	Min 4 hrs	Min 8 hrs	Min 16 hrs	Min 23 hrs
	Hours per evening		Min 1 hrs	Min 2 hrs	Min 3 hrs	Min 4 hrs	Min 4 hrs
Reliability						Max 14 disruptions per week	Max 3 disruptions per week
Quality						Voltage problems do not affect the use of desired appliances	
Affordability					Cost of a standard consumption package of 365 kWh per annum is less than 55 of household income		
Legality						Bill is paid to the utility, prepaid card seller or representative	
Health and Safety						Absence of past accidents and perception of high risk in the future	

3. Types of solar home systems:

This report analyzes fiscal treatment of two types of systems: plug and play kits and component-based systems.

- **Plug and play kits:** portable, pre-configured, pre-wired systems that are installed in customer houses. This report includes those between 11 to 50 W capacity considering the lowest price of USD 108.[12]
- **Component-based systems:** systems where different parts – such as the battery, bulbs, wiring panel – are sold independently and then assembled when installed in the customer's house. This report includes those between 11 to over 100 W capacity, considering a price range of USD 158-420.[13]

This report assumes sales through both cash and credit, with a repayment period averaging 12 months.

[11] Energy Sector Management Assistance Program, Beyond Connections Energy Access Redefined, 2015
[12] Mapping the Ugandan off-grid energy market, Uganda Off-grid energy Market Accelerator (UOMA), March 2018
[13] Mapping the Ugandan off-grid energy market, Uganda Off-grid energy Market Accelerator (UOMA), March 2018

4. Fiscal policy options

This report analyzes cost-benefit scenarios for the implementation of tax and/or subsidies as the only fiscal interventions to accelerate growth of solar home systems in Uganda.

- **Tax options:** Currently in Uganda, operators selling solar home systems are exposed to two different kinds of taxes: those based on business operations, such as corporate income tax, and those based on the product, such as value-added tax (VAT) and import duties. Recent amendments to the Excise Duty Act 2018 (mobile money tax) introduce a new category that will affect PAYG transactions through mobile money directly. This analysis, however, focuses on the effect of variation in the currently implemented product-based taxes, VAT and import duties, on the uptake of solar home systems.
- **Subsidy options:** This report focuses on both market and consumer-facing interventions that 1) attract more players to the sector, increasing competition and improving access in hard to reach areas, and 2) reduce the cost to the consumer and increase affordability respectively.

The results of the analysis reflect the assumption that these interventions are fully enacted with an implementation risk of 5% – a premium attached to cater for risk of program failure caused by several unforeseen factors.

5. Timelines and phasing

Our analysis recommends the government implement fiscal policy incentives in three phases, assuming an "aggressive market approach," as described in the draft REA Off-grid Strategy.[14] These phases allow for first addressing supply challenges to ensure solar home systems are available where they are demanded, and later demand side challenges such as affordability. This type of phasing allows for minimal distortion and considers the timelines set by the government in the REA Master Plan for Uganda, Free Connection Policy and Rural Electrification Strategy and Plan (RESP).

[14] Draft Uganda Off-Grid Strategy for Stand Alone Solar Systems and Mini-Grids prepared by NRECA International for USAID – Uganda Electrification Expansion and Improvement Program Cooperative Agreement No. AID-OAA-A10-00028, April 2018

TAX OPTIONS

The analysis for this report reviewed five potential scenarios for the treatment of VAT and import duty on solar home systems and the effects these would have on uptake in the industry as seen in Figure 4 below.

The government categorizes components of energy products as either generation, transmission or productive use. For this report, we analyzed tax treatment of the two types of solar home systems based on the government's classification of solar generation and transmission. (See *Detailed Assumptions* section for further breakdown)

Figure 4: Tax scenarios

		VAT		Import duties	
	Scenarios	**Solar generation**	**Solar transmission**	**Solar generation**	**Solar transmission**
T1	Business As Usual*	0%	18%	0%	25%
T2	All taxes removed	0%	0%	0%	0%
T3	Only VAT applied	18%	18%	0%	0%
T4	Only Import duties applied	0%	0%	25%	25%
T5	All taxes applied	18%	18%	25%	25%

*Business as Usual scenario shows the current situation with tax exemptions on solar generation components only.

Findings:

The analysis for this report revealed (as seen in Figure 5 and 6 below):

- T2 with full VAT and import duty exemptions on solar products, has the largest growth in connections (117,178 additional SHS). Furthermore, the government would lose more than USD18M in tax revenue making it less than optimal
- Similarly, T5 where all exemptions are removed may accrue the government an additional USD15M in tax revenue, but the scenario enables only 4% growth in connections leaving access targets even shorter than the current regime with close to 700,000 connections foregone
- The current tax regime, T1, includes some VAT and import exemption (only on solar generation) and enables a 10% growth in connections. This therefore provides a balance of access and tax revenue that is the most optimal and favorable for the growth of SHS

It should be noted that any optimal scenarios will only be successful with effective implementation. Some options are explored in the *Implementation section* of this document.

Figure 5: Growth in SHS uptake based on the varying tax scenarios

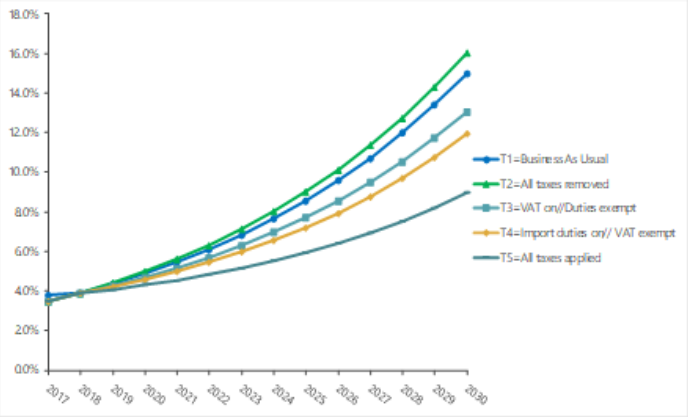
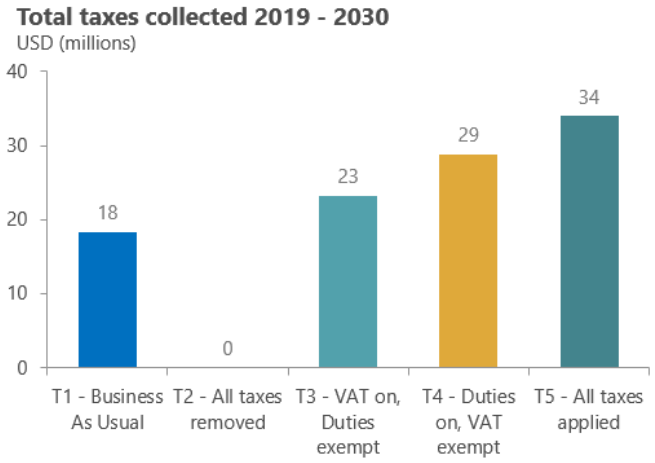


Figure 6: Total taxes collected between 2019 and 2030 per tax scenario



SUBSIDY OPTIONS

The analysis looks at five subsidy scenarios under two main goals – stimulating supply and demand (as shown in Figure 7). The implementation mechanisms of each of these subsidies are explored in later sections:

1 Stimulating supply by enabling operators to reach the unserved

The goal of any subsidy to operators would be to enable consumers to have access to off-grid solar products regardless of location by increasing the distribution capacity of businesses. The analysis for the report examined:

- **Incentives to providers** (S1) reaching specific regions that are not commercially feasible or have high costs for distribution
- **Working capital facilities** (S2) to aid businesses to offer consumer financing and flexible payment terms to reach more people

2 Stimulating demand by subsidizing price to those that can't afford

The goal of any subsidy to end consumers would be to stimulate demand where supply exists, but a number are unable to afford at current market prices. The analysis for the report looks at the following options:

- **Direct subsidy** (S3) to end consumers for part of the price of the SHS unit
- **Partial price subsidy** (S4) to end customer given to the operator
- **Consumer financing** (S5) made available through financial institutions offering cheaper credit options to end consumers

Figure 7: Subsidy scenarios

Intervention		Type of subsidy	Target	Implementor	Value of subsidy
Supply side stimulation	**S1**	**Incentives to providers for hard to reach areas**	Operators	Government agency	Based on cost to serve specific region
	S2	**Working capital facilities**	Operators	Financial institutions	Based on cost to serve and operate
Demand side stimulation	**S3**	**Direct subsidy**	End consumers	Government agency	Based on price of system and customer willingness to pay
	S4	**Part subsidy**	End consumers	Operator	Based on price of system and customer willingness to pay
	S5	**Consumer financing facilities**	End consumers	Financial institutions	Based on price of system and interest rates offered on the market

Findings:

Across the five subsidy scenarios analyzed in Figure 8, the most cost-effective option is S2 - supporting businesses to finance inventory carrying costs for products offered to consumers on flexible payment terms. Two methods of delivery were evaluated considering an on-lending facility and risk sharing partnership such as a guarantee.

Figure 8: Results of cost-benefit analysis of individual subsidy options

	Subsidy options	Projected connections added	Estimated cost of intervention	Benefit-Cost ratio
S1	Incentives to providers for hard to reach areas	1,701,254	$5,177,041	0.06
S2.a	Working capital- facility	3,185,183	$82,871,659	0.02
S2.b	Working capital- guarantee	3,242,303	$3,922,304	0.47
S3	Direct subsidy to end consumers	1,675,568	$4,415,833	0.06
S4	Part subsidy through provider	1,733,466	$11,033,250	0.03
S5.a	Consumer financing-facility	1,574,253	$9,276,105	0.02
S5.b	Consumer financing- guarantee	1,586,418	$2,796,723	0.07

While the analysis shows that some interventions have a lower benefit-cost ratio, it is important to note that they cannot all fully serve the entire unserved population. For example, a working capital facility will stimulate the industry and attract more players and growth in sales across the country, but only serves for consumers who can afford the products and are in regions that operators consider commercially viable.

Similarly, any demand stimulating subsidies such as those on price should not be applied across the country as they would be distortive to the market and would instead slow down the growth of the sector. The demand stimulating options are thus best implemented with a regional perspective to ensure sustainability of the markets opened.

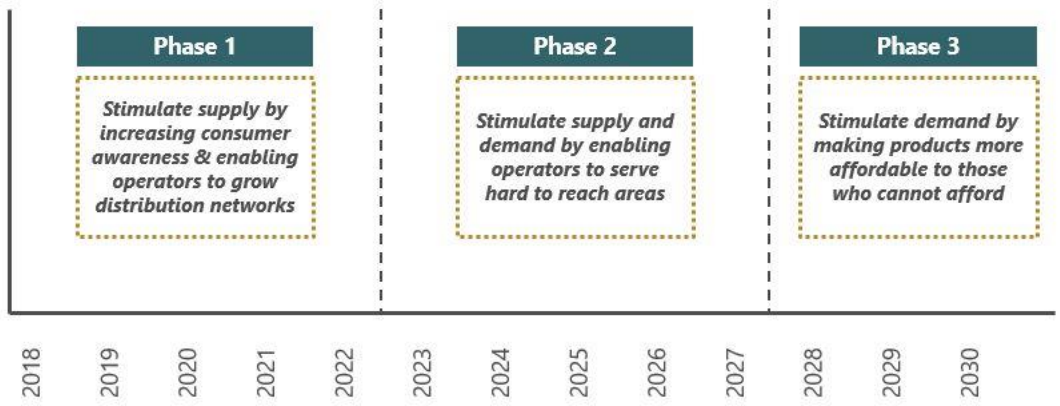
The following section of this report explores ways in which these interventions can be rolled out together to complement each other and enable the country to meet its access targets.

COMBINATION OF INTERVENTIONS

Based on the analysis for this report, we expect the market to grow organically and contribute 1.4 million off-grid connections with the current tax regime maintained. The focus of our recommendations in this section will be on implementing subsidy options to complement and enable further growth.

As mentioned above, it is optimal to maintain the current tax regime and focus on implementing subsidy options to complement and enable growth. We recommend a phased approach where various interventions allow for first addressing supply challenges to ensure solar home systems are available where they are demanded, and later addressing demand-side challenges such as affordability as shown in Figure 9 below.

Figure 9: Phasing for recommendations



1. **Phase 1 (2019-2022):** This focuses on stimulating supply by increasing consumer awareness and enabling operators to grow distribution networks. This will include a working capital facility (S2) which is set up to provide financing to operators and a subsidy given to incentivize the cost to serve further regions (S1).
2. **Phase 2 (2023-2027):** This focuses on stimulating supply and demand by enabling operators to serve hard to reach areas. The interventions in this phase are: risk sharing instruments like guarantees (S2), incentives for operators to serve hard to reach areas (S1), and a facility to provide consumer financing (S5).
3. **Phase 3 (2028-2030):** Given the significant growth in distribution and supply, this phase will focus on stimulating demand and enabling end consumers who cannot afford the products available in the market. This can be achieved through further interventions with consumer financing (S5) and direct subsidies for end consumers (S3).

Findings:

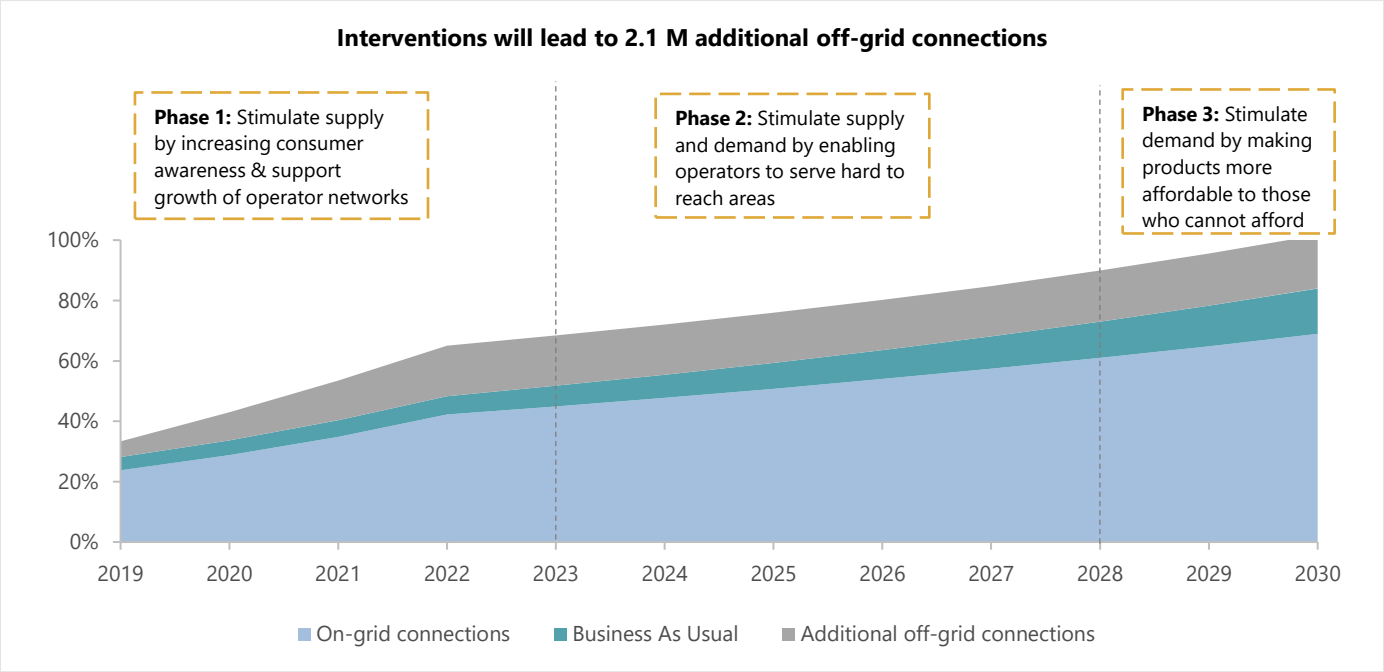
The phased approach enables 2.1 million additional connections at a cost of approximately USD57 million, as seen in Figure 10 below.

Figure 10: Combined and phased fiscal interventions

		Interventions	Projected connections added	Estimated cost of intervention
Phase 1 (2019-2022)	**S1**	**Incentives to providers for hard to reach areas**	72,967	$2,367,781
	S2.a	**Working capital-facility**	728,970	$49,474,038
	S2.b	**Working capital-guarantee**	735,833	$2,309,424
		Total	1,537,770	$54,151,243
Phase 2 (2023-2027)	**S5.a**	**Consumer financing-facility**	71,151	$1,877,563
	S1	**Incentives to providers for hard to reach areas**	155,450	$2,285,987
		Total	226,601	$4,163,550
Phase 3 (2028-2030)	**S5.b**	**Consumer financing-guarantee**	87,931	$829,475
	S4	**Part subsidy through providers**	70,065	$2,657,412
	S3	**Direct subsidy to end consumers**	115,744	$1,063,575
		Total	273,740	$3,720,987
Total connections projected from interventions			**2,038,111**	**$62,035,781**

From the government's plans to extend the grid to 60% of the population, there's a need for the off-grid sector to connect approximately 40% of the population at 2030. With the phased interventions, there's a total of 2 million connections added from 2019 to 2030. These added interventions in addition to the organic growth of the market will enable closure of the gap to universal access by 2030 as seen in Figure 11 below.

Figure 11: Uptake from phased interventions



It is important to note that this analysis does not consider implementation mechanisms for the interventions which would significantly affect the cost and level of impact on the market. These are discussed in the *Implementation section* of this report.

Important to note that these numbers are subject to change following the finalization of the Uganda REA Off-grid Strategy

IMPLEMENTATION

In order to achieve the set targets for universal access given fiscal policy interventions, there is a need to address key challenges in the market.

a. Strengthen capacity of the local tax authority and create clarity on the taxation policy

Operators report inconsistent taxes being applied to the same products, both across companies and within individual containers of the same products. This makes it difficult for companies to predict costs, to price appropriately, and to attract investors raising the intrinsic costs passed on to customers.[15]

In the short term, strengthening the capacity of regulatory bodies will lay the groundwork for more effective enforcement in future. This will involve investment in more customs personnel and technology to help with screening, training of customs officials, and developing a handbook to help the regulators identify and clearly define the tax treatment of different components.

In the interim, the government can consider more direct interventions for companies selling component-based systems and productive use technology such as corporate tax holidays and incentives for market entry. It can also explore incentives through implementation measures such as zero rating, reductions in withholding tax, and other taxes related to business operations.

b. Adapt product standards and create awareness of standards

Solar home system company growth is stunted by a lack of product standards and awareness of standards, both contributing to low consumer confidence and inconsistent regulation from the customs office. Due to the lack of clear product standards, port authorities have aggressively blocked the import of some solar products or inconsistently taxed different products and companies.

More recently, the Uganda Solar Energy Association (USEA) has made efforts to help the Uganda Regulatory Authority (URA) identify companies for exemptions by writing letters to certify members. A more permanent solution or certification to increase trust and ease identification should be explored.

The government should adopt global standards and create a standardized certification for units managed by an entity such as the Ugandan Bureau of Standards. This will help create clarity on tax treatment and increase consumer confidence.

c. Review and implement efficient subsidy delivery models relevant to the local context

Uganda has previously explored mechanisms where subsidies were based on size of the installed systems as part of World Bank's Energy for Rural Transformation Phase I. While the capacity targets were met, the intended goal to get operators to reach commercially unattractive areas was not achieved. On review of the program, it was agreed by the government that a demand-driven model would be too premature for the Ugandan market and required operators to reach a higher level of traction to be more responsive to these kinds of interventions.[16]

The government and development partners have also explored various models, for example the PVTMA program as part of World Bank's Energy for Rural Transformation Phase II implemented by REA, where subsidies were based on the end users and targeted smaller companies to ensure that they reached poorer households. Due to the very targeted nature of the subsidy, several administrative mechanisms like full verification were added to de-risk the program, however, these added

[15] Uganda Solar Energy Association – Policy Paper

[16] World Bank 2010. Independent Evaluation of ERT I, available from: http://documents.worldbank.org/curated/en/165331474489022932/pdf/000020051-20140620075303.pdf

delays for the operators. These delays negatively affected the cashflows of participating operators leading to lower participation and decreased trust in the programs.[17]
Globally, governments continue to explore three key subsidy delivery models: sales models provided either to the 1) operators or 2) directly to customers, and 3) market package models given to a specific company on concession or non-concession. [18]

ECA's research explores the advantages and disadvantages of using either approach in Figure 12 below:[19]

Figure 12: Review of global subsidy models

	Sales/dealer models *Subsidy is provided for solar products sold by approved suppliers who compete with each other*	**Market package models** *A single supplier is awarded the right to receive a subsidy for systems sold to users in a defined rural area*	**Market package concession models** *A concessionaire is given the sole rights to provide SHS and to collect revenues from users in a given area*
Criteria	- Rural areas - Certain population categories - Quality standards	- The bidder requesting the lowest subsidy is awarded the rights - Quality standards	- The concession will normally be awarded following a competitive tender
Delivery mechanism	- Directly to the dealer after proof of sale - *Voucher to the end-user* - *Verification triggers disbursement*	- Directly to the dealer after proof of sale - *Voucher to the end-user* - *Verification triggers disbursement*	- The concessionaire owns and maintains the systems/acts like a small utility - Fee for service
Variations	- Credit option by supplier or MFI	- Credit option by supplier or MFI - *Maintenance contracts*	- Ownership of the SHS with supplier/end user - Allocation of concession to the utility
Pros and cons	- Easy to launch - Strong competition should lead to cost efficiency and product innovation - Private participants take full risk until delivery - The incentive for maintenance resides with the household - *Pre-financing constraint* - *Cost of monitoring (check claims by sellers/paper checks)*	- The dealers' marketing costs and the costs of meeting warranty obligations and on-going maintenance are substantially reduced - Removes the competition element	- Supplier is obliged to maintain the SHS, otherwise no fee - Takes out the 'wild west' aspect of SHS financing - The concessionaire is granted a monopoly so a regulatory framework is required - May suppress innovation and cost reductions

The key for the proper implementation of these models is ensuring there is an appropriate monitoring process to ensure operators are effective and incentivized, including checks for quality and energy efficiency. Across the different models, the Sustainable Solar Market Packages (SSMP) scheme and Results-Based Financing (RBF) sales model have been effective in solving the above challenges in different geographies. *(See case studies included in ECA's report analysis).*

However, there has been pushback from the industry in Uganda given the experience in East Africa and from previous models in utilizing the said models. For any programs offering a subsidy, there will be a need to incorporate firmer implementation from the design phase.

[17] ECA report on fiscal policy options for Uganda
[18] ECA analysis of Off-Grid Energy policy in Uganda
[19] ECA analysis of Off-Grid Energy policy in Uganda

Additionally, we recommend further surveys and research articulating the challenges for operators utilizing these mechanisms in Uganda to add local context to the design of subsidy schemes.

d. Develop strategies and innovative distribution models to serve hard to reach rural areas

Unserved markets are heterogeneous and require unique solutions to serve. However, today, these unserved populations are not clearly defined, preventing public and private sector actors from understanding how to reach them.
For the demand stimulating interventions to be successful, it is important to align mechanisms and partner with implementors relevant to the type of communities and affordability of consumers.
Programs and operators may leverage the use of savings groups such as SACCOs, women's groups, religious groups, schools and health centers that influence consumer perceptions.

e. Provide technical assistance to both businesses and domestic banks

In the past, several facilities provided to banks by the government and development partners have been underutilized including consumer financing facilities provided by the Uganda Credit Capitalization Company. This has been due to challenges such as a limited pipeline of businesses that meet their criteria, and lack of technical capacity at the banks to adequately evaluate businesses or give consumers advice on solar products to purchase.

It is important that the working capital and consumer financing facilities to be implemented through banks incorporates a technical assistance component to help domestic banks understand the potential in the industry and build their internal capacity. Additionally, support to businesses is required to help them incorporate the necessary systems and processes to instill investor confidence.

NEXT STEPS AND CONCLUSIONS

Based on the analysis, the current tax regime complemented by the subsidy interventions will enable approximately 2 million incremental connections helping the country achieve 100% access. In order to achieve this, the government will need to examine the implementation mechanisms highlighted to ensure any interventions are effective.

As a follow-up to the publication of this report, the UOMA team will:

1. **Disseminate summary findings to reach all relevant stakeholder groups**
   UOMA will share these findings with key stakeholders to review the results of the analysis. This exercise will culminate in a stakeholder workshop to present the results to an even bigger audience for review before finally presenting these recommendations to policymakers.

   This report will then be shared with various government agencies such as Ministry of Energy and Mineral Development (MEMD), Ministry of Finance, Planning and Development (MOFPED) and the Rural Electrification Agency (REA).

2. **Lobbying and implementation**
   The UOMA team will then continue work to ensure the recommendations made are included in the government strategy and policies. This will include preparation of reports, advocacy convenings, and forming the necessary partnerships for adoption.

APPENDIX

1. Policy and Regulatory Framework of OGE in Uganda

Energy in Uganda is guided by several policy documents. Key to the regulation is the National Energy Policy (NEP) which was launched in 2002. NEP outlines the government's intention to use access to modern and reliable energy as a tool to reduce poverty. Subsequently, the government launched the Renewable Energy Policy (REP) in 2007, a policy central to renewable energy. In addition to these two, off-grid energy is regulated by SE4ALL Action Agenda, Investment Prospectus (2015), Rural Electrification Strategy Plan (RESP) 2013 – 2022 (2012), Uganda Vision 2040 (2013), and the National Development Plan II (2015).[20]

The government policies developed or being drafted, and the direct support of off-grid electrification programs have helped the industry's development to some degree by providing increased acknowledgment to the private sector on the role of off-grid RE. Additionally, through the creation of policy and documentation related to off-grid RE, the relevant public sector agencies are increasingly able to secure more Government funding for the sector. The budget setting process is shown in the Appendix.

Overall, private sector growth requires a high degree of political stability and macroeconomic certainty which enable businesses to win investment and maintain sales. Any fiscal interventions in Uganda must, therefore, consider the country's key agencies and actors that determine off-grid RE policy, and the policies that allow public programs and the private sector to succeed.

2. Key government agencies with impact on renewable energy

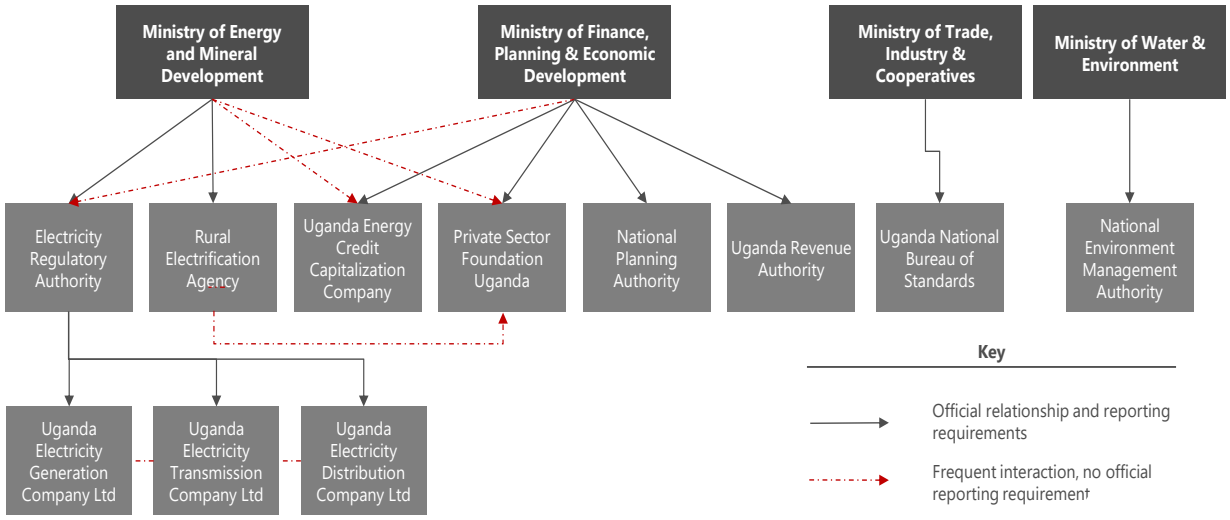
Several government entities have an interest and mandate that includes off-grid RE. Figure 13 shows the relationship between government and agencies related to energy. A summary of the mandate of each entity is included below:

a. **The Ministry of Energy and Mineral Development (MEMD):** MEMD has the mandate to manage the development and utilization of energy and mineral resources in Uganda. It is therefore responsible for formulating related energy policies, overseeing the establishment of power generating infrastructure and investment into mineral exploration
b. **The Rural Electrification Agency (REA):** The agency implements government projects for rural electrification under the Rural Electrification and Strategy Plan (RESP).[21] This includes both on- and off-grid solutions, including grid extension, independent micro-grids, off-grid solutions like solar photovoltaic systems, and energy generation projects.[22]
c. **The Energy Regulatory Authority (ERA):** Is responsible for the regulation, licensing and supervision of licensed and/or registered companies for generation, transmission, distribution, and sale of electricity.
d. **The Ministry of Finance, Planning and Economic Development (MOFPED):** This ministry coordinates development planning, mobilizes public resources and ensures accountability for the use of these resources.[23] As outlined in greater detail below, MOFPED leads the budgetary process and thus, is responsible for allocating resources to off-grid programming implemented by the ministries.
e. **Uganda Energy Credit Capitalization Company (UECCC):** It was established to facilitate investment in Uganda's renewable energy sector by catalyzing private sector participation through the Uganda Energy Capitalization Trust.[24] The company provides financial and technical support through several products for example, loan facilities, credit enhancement instruments such as guarantee facilities, re-financing and working capital funds.

[20] ECA analysis of Off-Grid Energy policy in Uganda
[21] Rural Electrification Strategy and Plan, 2013-2022
[22] http://www.rea.or.ug
[23] http://www.finance.go.ug/about/about-mofped/
[24] http://www.ueccc.or.ug

f. **Uganda Revenue Authority (URA):** URA's mandate is to collect government tax revenue, assess tax need, account for the tax collected as well as advise the central government on matters relating to policy.[25]

Figure 13: Relationships between government ministries and agencies related to energy[26]



3. Detailed assumptions and tables

This section delves into the various assumptions considered for the analysis. It explains the rationale and highlights the sources, such as government policies and sector publications, from which the assumptions are derived. The section is categorized into 3 sections:

1. General assumptions

a. Timelines

The analysis for this report is conducted over a 15-year period (2016 – 2030) with projections beginning in 2018.

b. Population

According to the Uganda National Bureau of Standards, the population of Uganda in 2017 was 37,700,000 with the average size of household taken as 4.7.[27,28] This population is projected at a rate of 2.8% from 2018 onwards.[29] The model considers urban population to be 24.50% in 2017 with an urbanization rate of 5.3%.[30,31] For purposes of determining the ability to pay across different regions in Uganda, the model relies on research done by the World Bank on income distribution in which 19% of the population are living below the poverty line, 43.3% are at risk of slipping back into poverty and are surviving on less than USD 7 per day, while only 37% are considered to have the middle income status.[32]

[25] www.ura.go.ug
[26] Analysis from interviews and government websites
[27] Uganda Bureau of Statistics, Annual Statistical Abstract, 2017
[28] Catalyst report
[29] Catalyst report
[30] Uganda Bureau of Statistics, Uganda National Household Survey, 2016/2017
[31] https://www.indexmundi.com/uganda/urbanization.html
[32] World Bank, Uganda Poverty Status Report, 2016

c. *Electrification rate*

The analysis for this report takes into consideration the government's grid electrification targets for the years 2022 and 2030 outlined in RESP II and the REA Off-grid Strategy respectively. As a starting point, in 2017, 1.3 million households had grid electricity.[33] Additionally, the analysis accounts for 260,715 cumulative SHS systems sold by December 2017.[34] It's worth noting that this does not account for the off-brand generics that are widely sold across the country. The analysis also assumes a conservative 15% annual growth in SHS sales.

d. *SHS sizes and prices*

The analysis on SHS focuses on two types of systems – plug-and-play and component-based systems. The systems are categorized into three capacity ranges: 11 - 50W, 50 - 100W and lastly >100W. Further assumptions are that majority of the SHS in the market are plug and play systems accounting for 60% of sales and to that end, the analysis assumes only 40% are component-based systems. This split considers the many off-brand generic component-based systems that are widely sold in the market but are not documented. According to the Uganda National Bureau of Statistics 69% of the SHS sold are in rural areas with the rest in urban areas which is partially due to the higher grid electrification rates in urban areas.

The prices of different systems shown in Figure 14 below are based on desk research on the available products in market. The analysis considered the lowest price of system per capacity category.
The analysis further assumes a continual price decline at 1.17% annually until 2030 given the rapid technology advancement in SHS manufacturing. For example, lithium battery prices declined by a cumulative rate of 20% between 2010 and 2017.[35]

Figure 14: Prices of system per capacity[36]

System capacity	Lowest price (USD)
Plug and play	
11-50W	108
Component based	
11-50W	158
50-100W	280
>100W	417

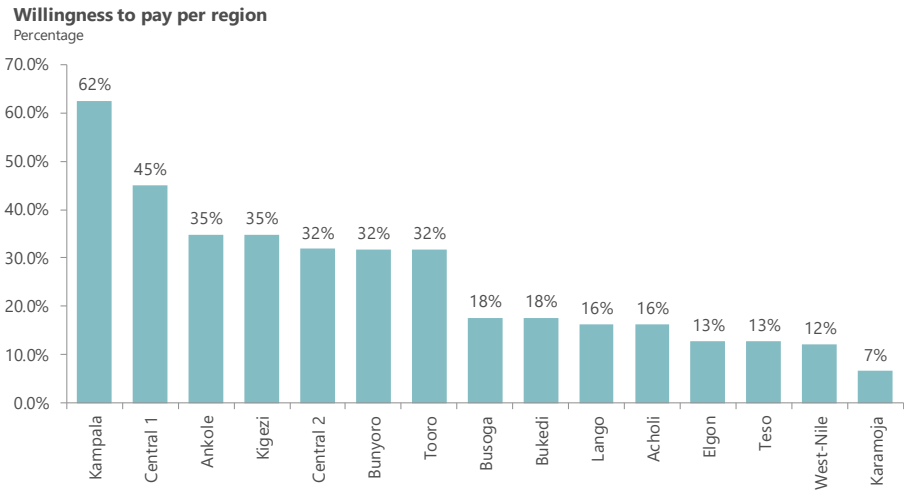
The analysis further considers that any interventions would reduce the price of systems to end consumers and increase the rate of uptake. Based on research and consultations, price elasticity of demand was estimated at -0.5.[37]

e. *Willingness to pay*

Given "business as usual" scenario growth, there will be a shortfall of connections by 2030. Due to varying levels of income and willingness to pay, only a portion of these households will purchase systems. Therefore, even when providers are supported to reach these unserved areas, not all the systems available will be sold. Based on the income distribution by region, past solar penetration per region, and willingness to pay surveys conducted by NRECA, the analysis assumes varying willingness to pay per region as shown in Figure 15 below.

Figure 15: Willingness to pay per region

[33] Off-grid Strategy concept paper
[34] Catalyst report
[35] GOGLA, Off-Grid Solar Market Trends Report, 2018
[36] UOMA market analysis
[37] UOMA research and consultations



2. Tax assumptions

Taxation on SHS products in Uganda is based on the use of the product's component which is specifically differentiated as solar generation, solar transmission and productive use by the government. For the two types of solar home systems considered, the number of components classified as generation and transmission varies. Figure 16 highlights the assumed value of the total cost of the unit considered a solar generation or solar transmission component for the two types of standalone systems.

Figure 16: Share value for component classification

	Share value	
System type	Solar generation	Solar transmission
Plug and play	85%	15%
Component based	40%	60%

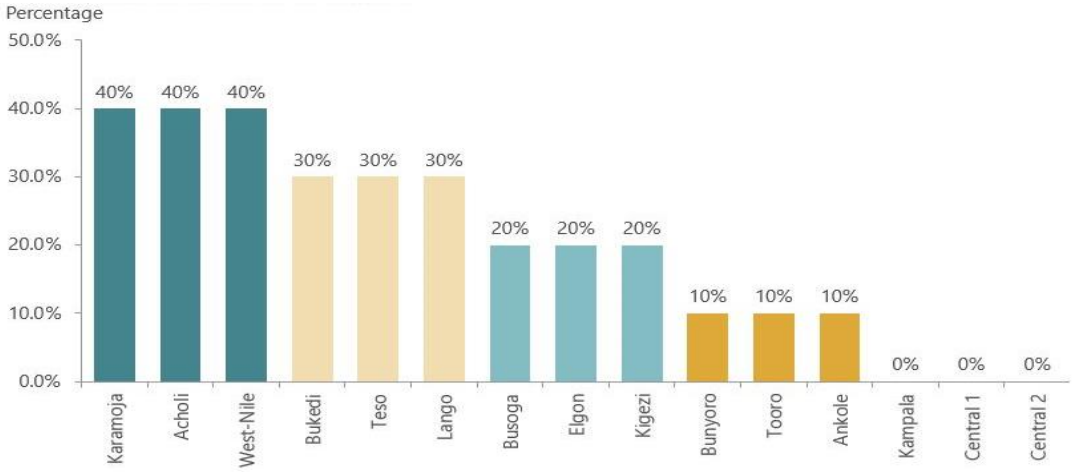
3. Subsidy assumptions

There are several subsidies that can be considered by government to increase supply and uptake of solar home systems. The assumptions made varied either by how the subsidy was computed or based on who the recipient would be.

a. Based on value of subsidy

- **Subsidy for price based on location:** Given the varying level of economic development per sub-region in Uganda, an economic analysis was conducted to arrive at the subsidies (as a percentage of price) given to consumers in each sub-region to stimulate demand with minimal market distortion. The economic analysis relied on a combination of factors to arrive at the percentage of price to be subsidized. There are three key factors considered – grid connections, mean income, and distance from the capital city which reflects the relative ease of distributing SHS to the specific sub-region. Figure 17 below shows the resultant percentage subsidies granted based on price per region.

Figure 17: Subsidy based for price per region



- **Subsidy based on capacity:** While the projection model was built with the functionality of having varying subsidies granted per solar home system size, a uniform assumption – 10% of the price – was made for all system sizes. This was to ensure that consumers with different energy needs are catered for and solar home system sales are not skewed to one size. Figure 18 illustrates the assumptions made per system size.

Figure 18: Subsidy based on capacity

System capacity	Lowest price (USD)	Subsidy
Plug and play		
11-50W	108	10.00%
Component based		
11-50W	158	10.00%
50-100W	280	10.00%
>100W	417	10.00%

b. Based on recipient

- **Subsidy to users through provider:** The analysis looks at two scenarios – with and without competition between providers. The analysis assumes that there is a higher implementation risk and lower rate of success when the subsidy is provided to a private operator without competition. The other scenario is considered to have a higher success rate and lower implementation risk. However, the programmatic cost is assumed to be the same. The summary of the assumptions made are shown in Figure 19 below.

Figure 19: Subsidy through provider

	Effect of subsidy on final price to consumer	Risk of implementation	Programmatic cost
Provider with competition	100%	25%	15%
Provider without competition	80%	40%	15%

- **Subsidy to users through financial institution:** Two types of subsidies that relate to financial institutions are considered for the analysis - 1) Facility 2) Risk share Guarantee (shown as guarantee in figure 18). The assumptions with

regards to interest rates to users for each of the subsidies as well as the amount of risk taken on by the financial institution are shown in Figure 20 below.

Figure 20: Subsidy through financial institution to users

	Percentage
Facility	
Facility rate	6%
Bank risk share	80%
Guarantee	
Facility Rate	5%
Bank Risk Share	50%

- **Working capital facility for provider through financial institution:** As mentioned in the consumer facing subsidies' section above, two types of subsidies are looked at for the analysis - 1) Facility 2) Risk share guarantee. The assumptions made regarding the working capital facility to providers/private operators are shown in figure 21 below.

Figure 21: Terms of working capital facility through financial institution

	Percentage
Facility	
Facility rate	6%
Bank risk share	80%
Guarantee	
Facility Rate	5%
Bank Risk Share	50%

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