Kenya' VAT Impact Study Report

1. Introduction

Study Objectives

In June 2020, the Kenyan Parliament approved the Finance Bill 2020 and the Tax Laws (Amendment) Bill 2020. This new legislation proposed measures that will increase the cost of imported solar panels, batteries, clean cooking stoves, and dedicated equipment used in off-grid sector, negatively affecting growth in the broader off-grid sector. The Kenya Renewable Energy Association (KEREA) has been working since the bill's introduction to advocate against the removal of VAT exemption on solar products, and ACE TAF provided support to undertake a review of the proposed bills. In May 2020, KEREA published an analysis of the proposed bills and their impact on the off-grid sector. In addition, KEREA retained KPMG to lead their lobbying efforts. Despite the concerted efforts by the sector, the Finance Act 2020 that was signed into law on 30th June 2020 introduced Value Added Tax (VAT) on previously exempted items. The African Mini-grid Developers Association (AMDA) is working closely with a consortium of stakeholders to assess the impact of the new tax burden on the off-grid solar sector and in particular on the mini grid sector.

The purpose of this study is to support an economic and fiscal impact analysis of amendments to tax legislation covering VAT and investment incentives that are expected to negatively impact the mini-grid sector in Kenya. This study investigated the following impacts of the changes to VAT and import duties on the mini-grid sector, either qualitatively or quantitatively:

- Establish baseline data points to characterize the business case for mini grids prior to these new tax measures (e.g., typical rates of return, profit margins, tariffs, payback periods, etc.)
- The increase in the cost of solar equipment (capital expenditure for developers)
- Impact of increased equipment costs on end-user tariffs, connection costs, rates of return, and payback periods for developers
- Impact on attractiveness of Kenya as a market for mini-grid developers
- Impact on investor community perception of the mini-grid market in Kenya
- Impact on tax revenues to the Kenya Revenue Authority (KRA)
- Impact on direct and indirect employment creation

- Impact on Kenya's mini-grid development plans intended to help meet electrification goals under the Kenya National Electrification Strategy (KNES) and the Kenya Off-Grid Solar Access Project (KOSAP), which targets electrification in underserved counties.

2. Background

2.1 History Mini-Grid Sector in Kenya

The first mini-grid in Kenya is reported to have been set up in 1908 by Harrali Esmailjee Jeevanjee in Mombasa under the Mombasa Electric Power and Lighting Company. Around this time, Clement Hirtzel was granted an exclusive license to supply Nairobi with electricity and this was done under the Nairobi Power and Lighting Syndicate. These two mini-grids later merged to form the East Africa Power and Lighting Company which eventually evolved into Kenya Power and Lighting Company, now Kenya Power. National electrification in Kenya has traditionally been delivered through grid extension and densification, mainly led by Kenya Power and more recently through the Rural Electrification and Renewable Energy Corporation (REREC, former Rural Electrification Agency – REA). Decentralized renewable energy solutions, mainly solar PV applications, emerged in the early 1980s mainly driven by demand from donor-led projects such as powering schools, hospitals, and boreholes. This marked the first wave in the uptake of decentralized energy solutions. The price, ranging between US$ 30 and 40 per watt peak installed at the time inevitably constrained demand and uptake. A 40 Wp solar PV system enough to power a few light bulbs and mobile phone charging would cost about US$ 1,200 then putting access outside the reach of most household consumers. The application of solar PV powered source mainly driven by donor projects demonstrated the technical capability of solar PV technology which gradually attracted solar technicians, entrepreneurs, and suppliers of accessories such as batteries. Siemens, BP Shell, Solar Shamba, Chloride Exide, Energy Alternatives Africa, Electro watts, Associated Battery Manufacturers and others were some of the early movers. As the unit price of solar PV declined, more players were attracted and these included finance institutions, non-profits in energy access and distributors that could reach rural and remote users.

By the late 1990s decentralized solutions were viewed as a mainstream option although penetration was still relatively low. The mobile phone revolution that picked up in earnest in the early 2000s drastically shifted the dynamics through the provision of mobile payment platforms that propelled the pay-as-you-go business model. This was complemented by the continued decline in cost of solar PV products, concerns with the climate impacts associated with fossil fuel use, and the increase in energy efficiency across electrical appliances (including LED lighting). Sector actors through a project led by the Kenya Bureau of Standards to set up standards for the off-grid sector, transformed the then working group (Renewable Energy Resources Technical Committee) into the Kenya Renewable Energy Association (KEREA) in August of 2002. Up until this time, the Government's philosophy of electrification was centred on extending and expanding the central grid. The 1997 Rural Electrification Master Plan (REMP) by the Ministry of Energy which covered 46 of the 68 districts did not consider decentralized or stand-alone solutions. It is only after the establishment of the Rural Electrification Authority (REA) under section 66 the Energy Act of 2006 that this approach expanded to cover such solutions. Led by REA and under the guidance of the Ministry of Energy, the 2009 Rural Electrification Master Plan explicitly included decentralized approaches. Under this plan several public-sector mini-grids were constructed by REA then handed over to Kenya Power for end-user management. Also, through these efforts 90% of the then 25,873 trading centers were connected to the grid. Kenya has at least 21 public-sector mini-grids as shown in Table 1 below with an additional 26 solar PV powered mini-grids being developed by REREC in Wajir, Garissa, Turkana, Marsabit and Mandera counties. The 3.425 MW Lodwar (Turkana County) mini-grid commissioned in 1976 is the oldest isolated public-sector mini-grid in Kenya. An additional 60 kW based on solar PV was added to this site in 2012. During this year (2009), the Lighting Africa Programme led by the World Bank group that sought to standardize processes, policies, and products in the off-grid solar PV markets, was launched.

Table 1: List of public-sector mini-grids in Kenya (Source: NCI & EED, 2019)

County (Locality)	Commissioning Date	Number of Connections (June 2016)	Installed Capacity (October 2018)
Garissa (Daadab)	2016	4,800	• 784 kW (diesel)
Homa Bay (Mfangano)	2009	3,000	• 650 kW (diesel) • 10 kW (solar, 2013)
Isiolo (Merti)	2007	1,485	• 250 kW (diesel • 10 kW (solar, 2011)
Lamu (Faza)	2017	2,010	• 1370 kW (diesel)
Lamu (Kiunga)	2017	350	• 260 kW (diesel)
Mandera (Elwak)	2009	1,700	• 740 kW (diesel) • 50 kW (solar, 2012)
Mandera (Mandera)	1979	8,000	• 3,130 kW (diesel) • 330 kW (solar, 2013)
Mandera (Rhamu)	2013	400	• 520 kW (diesel) • 50 kW (solar)
Mandera (Takaba)	2013	500	• 320 kW (diesel) • 50 kW (solar)
Marsabit (Laisamis)	2016	160	• 264 kW (diesel) • 80 kW (solar)
Marsabit (Marsabit)	1977	8,200	• 2,900 kW (diesel) • 500 kW (wind, 2011)
Marsabit (North Horr)	2016	160	• 184 kW (diesel)
Tana River (Hola)	2007	1,300	• 800 kW (diesel) • 60 kW (solar, 2012)
Samburu (Baragoi)	2009	473	• 240 kW (diesel)
Turkana (Lodwar)	1976	9,598	• 3,425 kW (diesel) • 60 kW (solar, 2012)
Turkana (Lokichoggio)	2010	350	• 1,050 kW (diesel)
Turkana (Lokitaung)	2018	34	• 184 kW (diesel)
Turkana (Lokori)	2016	150	• 184 kW (diesel
Wajir (Eldas)	2013	342	• 184 kW (diesel) • 30 kW (solar)
Wajir (Habaswein)	2007	1,180	• 1,160 kW (diesel) • 50 kW (wind, 2012) • 30 kW (solar, 2012)
Wajir (Wajir)	1982	12,055	• 4,200 kW (diesel)

In 2014, through the draft Energy Policy then, the Government sought to increase the electrification rate to 65% by 2020 and attain universal electrification by 2030 through a three-prong approach that sought to i) expand generation and distribution infrastructure, ii) grid densification and iii) deploy innovative decentralized solutions. Developing of the now Energy Act (2019) among other actions transformed REA to the Rural Electrification and Renewable Energy Corporation (REREC). It was during this process that the 2018 Kenya National Electrification Strategy (KNES) was drafted. Through various initiatives including the Last Mile Electrification Project (LMCP), Global Partnership on Output-Based Aid (GPOBA) Slum Electrification Programme and the Kenya Off-grid Solar Access Project (KOSAP), KNES seeks to connect 269,000 households through grid expansion; 2.8 million households through grid intensification; 34,700 households through mini-grids and about 1.9 million though solar home systems. At least 151 mini-grids will be constructed under KOSAP. The evolution of Kenya's electrification strategy can be summarized in three waves as shown in Figure 1 below.

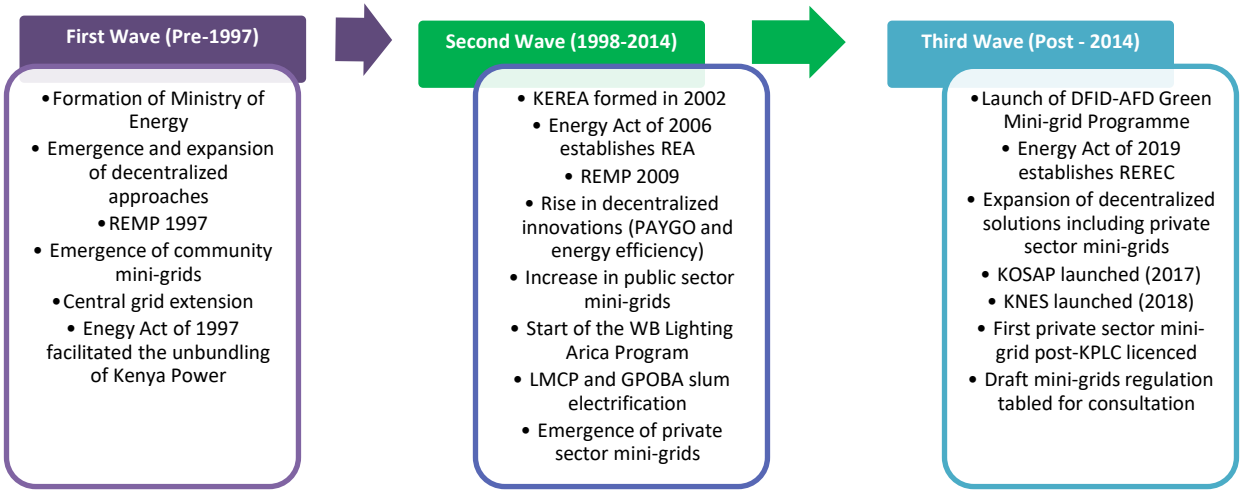

Figure 1: Evolution of electrification approaches in Kenya – A summary

Private sector mini-grids buoyed by the shifting attitudes towards rural electrification, recognition in global conversations around SDG-7 and availability of technical-financial support through programs such as the DFID-AFD Green Mini-grids Facility and GIZ RBF program are growing in number across the country. Although still much smaller in capacity and number of connections on average than the public sector mini-grids, the Ministry of Energy and the Energy and Petroleum Regulatory Authority (EPRA) are acknowledging their role through the ongoing drafting of the mini-grids regulations. By 2019, Kenya had an estimated 40 community-base and private sector mini-grids in operation as shown by Figure 2 below.

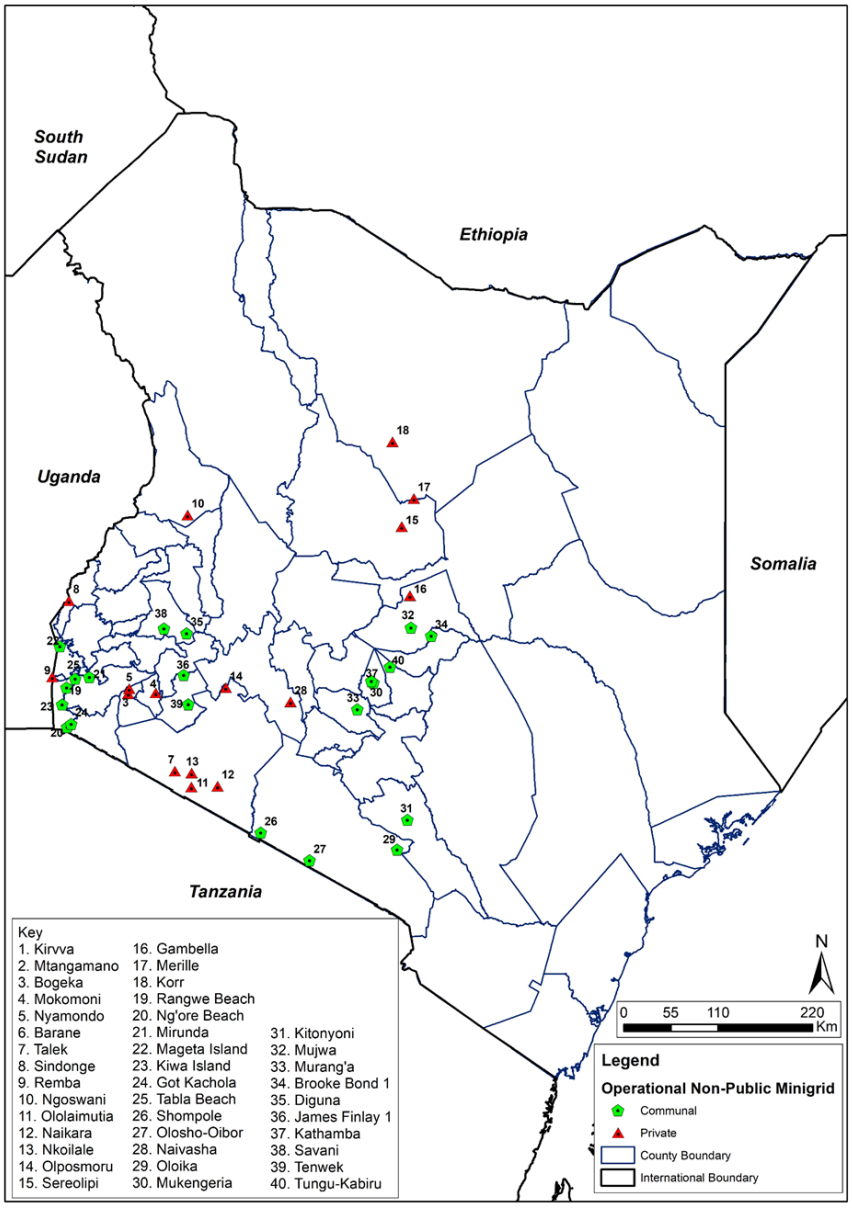

Figure 2: Map of community-based and private sector mini-grids in Kenya (Source: NCI & EED 2019)

2.2 Taxation in the off-grid solar PV sector

On 23 June 2020, the national assembly in Kenya (Parliament) passed the Finance Bill 2020 which among other things effectively re-introduced a 16% Value Added Tax on off-grid solar PV products. This Bill, which was assented into law on 30th June 2020 and now known as Finance Act No. 8 of 2020, removed the long-running VAT exemptions for "*specialized equipment for the development and generation of solar and wind energy, including deep cycle batteries which use or store solar power*"

The Government through various legislations has sought to provide incentives through reduced VAT on solar PV equipment and accessories since the year 2012. Zero-rating of "*solar equipment and accessories the exclusively use and/or store solar power*" first emerged in the now repealed Kenya Value Added Tax Act of 2012. However, this was withdrawn the following year as the Value Added Tax (2013) did not contain similar provisions. Through the Finance Act of 2014, this provision was restored and was retained until 2018 when the Kenya Value Added Tax of 2013 was amended by removing the team "accessories" under item 45 thus limiting the provision to "*specialized equipment for the development and generation of solar and wind energy, including deep cycle batteries*". This as an effort to harmonize these laws with those that exempt solar PV and associated equipment to import duty

under East Africa Community (EAC). Since 2004, the EAC Customs Management Act (2004) provided for import duty exemptions for specialized solar powered equipment and accessories. In 2014 this provision was amended to cover "*specialized equipment for development and generation of solar and wind energy, including accessories, spare parts and deep cycle batteries which use and/or store solar power*" a change from "*specialized solar powered equipment and accessories including deep cycle batteries which use and/or store solar power*". Under legal notice number 39 of 30th June 2016, this provision was further revised to cover "*specialized equipment for development and generation of solar and wind energy, including deep cycle batteries which use and/or store solar power*" as shown in Figure 3 below.

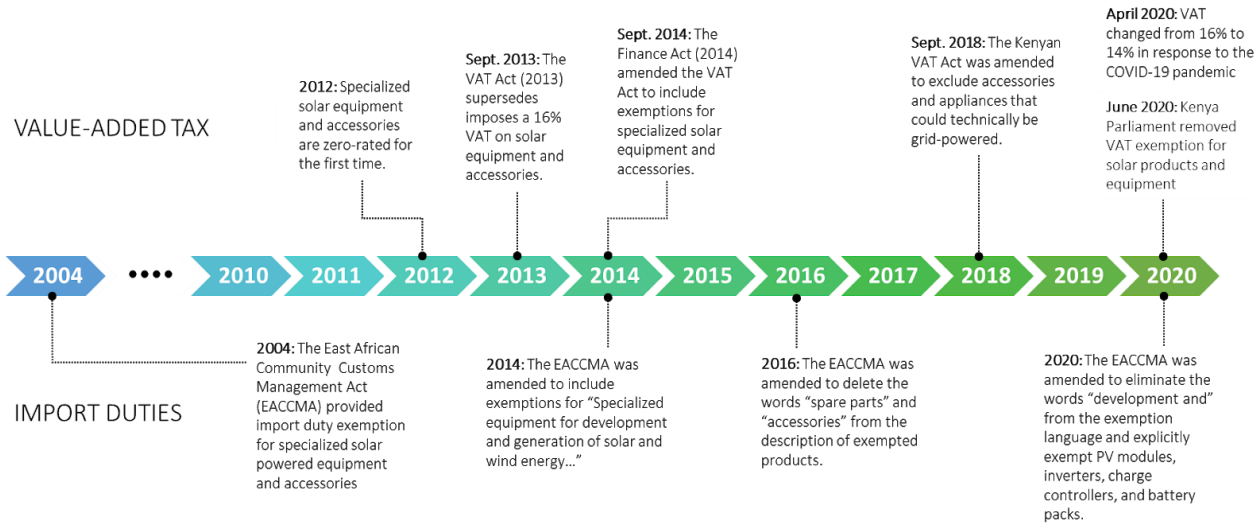

Figure 3: Timeline of off-grid solar VAT and import duty policies in Kenya

3. Study Approach

3.1 Stakeholder Interviews

The assignment was divided into five main tasks: i) methodology development, ii) mini-grid developer interviews, iii) stakeholder consultation, iv) analysis and v) deliverable development. Task ii) was further classified into three main sub-tasks: i) development of interview guides, ii) identification of key informants and implementation of the interviews, and iii) development of summary statistics and qualitative analysis. The interviews were based on semi-structured interview guides (see Annex 1). Interviews were held with four developers. This information was supplemented by aggregated information from the Africa Mini-grid Developers Association (AMDA). In addition to developers, and under task (iii), interviews with sector stakeholders including officials from the Ministry of Energy (Renewable Energy Department), Ministry of Energy (KOSAP) and the Energy and Petroleum Regulatory Authority (EPRA) were held.

Quantitative Analysis

The quantitative analysis of the study can be divided into two activities. First, the EPRA mini-grid tariff model was leveraged to understand the tariff impacts from the VAT increase. Specifically, the EPRA tariff model can be used to assess how a 16% increase in the CAPEX cost of PV panels, inverters, battery banks, and charge controllers would impact the cost reflective tariff, internal rate of return (IRR), and payback period of a project. Second, investor interviews and additional data sources were leveraged to estimate the impacts of reduced investor appetite due to the VAT.

Impacts include on forgone mini-grid construction, lost connections, reduced generation from renewables, and lost jobs.

1. EPRA Tariff Model

A pre-filled version of the EPRA tariff model was used for this analysis. It was provided by an in-country developer and included real financial and technical informational for a single 44 kW mini-grid site that they own. However, when comparing the cost inputs to the developer interviews and data from AMDA and ESMAP, the pre-filled inputs for the example site are an outlier. To ensure the results of the analysis are generalizable to the broader mini-grid sector for Kenya, the capital costs inputs are weighted to match the average distribution of costs found within the AMDA and ESMAP data. The categories that are reweighted are:

- Generation assets
- Distribution assets
- Logistics, transportation, warehousing
- Metering and termination
- Site development

However, within each category, the proportions of costs remain as they were from the original data. Those subcategories are as follows:

- Generation assets: Panels, panel trackers, inverters, panels racking, system ancillaries, SCADA
- Distribution assets: Dx and Rx station equipment, towers and poles, low voltage lines, communication equipment
- Logistics, transportation, warehousing: Customs clearance, transportation/delivery
- Metering and termination: Customer meters, billing system, connection cables, meter boxes, protections, customer interface units

The pre-filled version is set up for a 100% equity financing structure. However, this structure is not the norm for most mini-grid projects in Kenya. From experiences with mini-grid developers in-country, the most common equity to debt ratio is 30-70; as such, the financing structure is adjusted to this ratio. Additionally, it is assumed that the debt interest rate is 10%, with a debt origination fee of 1% and a debt term of 10 years. Loan drawdown is assumed to be 4% per month for 12 months.

Three system sizes are analysed with the tariff model, 22 kW, 44 kW, and 88 kW. To scale inputs with the differing system sizes, the following assumptions are made:

- Scales linearly with nameplate capacity:
    - Cost of generation assets
    - Cost of distribution assets
    - Number of customers
    - Cost of metering assets scales linearly with number of customers (and thereby with nameplate capacity)
- Labor scales nonlinearly with nameplate capacity (as show in Figure 4)
- Remains constant:
    - Cost of logistics
    - Distribution of components within generation assets, distribution assets, etc. (same original model distribution)
    - OPEX

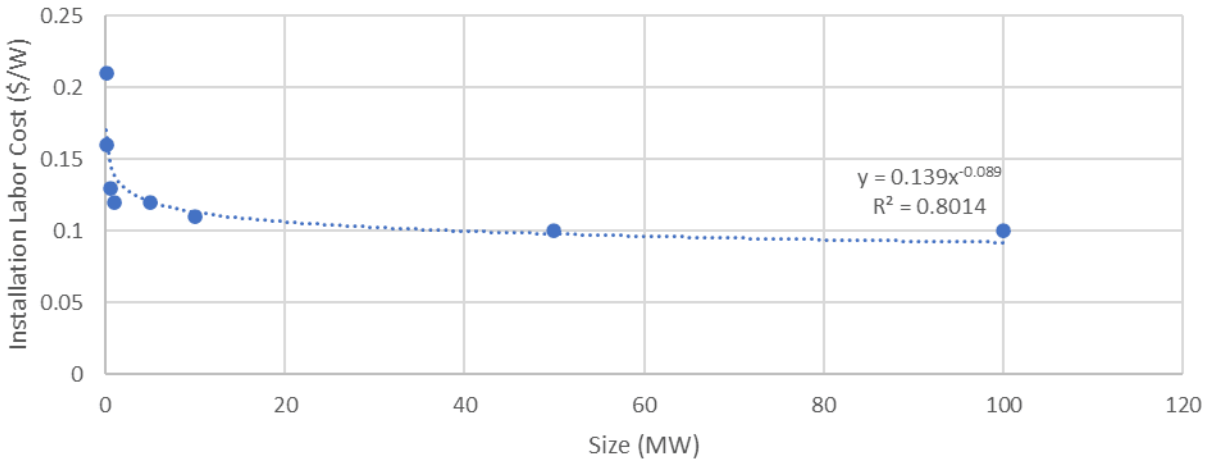

Figure 4: Relationship between installation labor costs and system size. Source: NREL, 2018.

Grants are also included within the tariff model. In Kenya, grants have been offered by donor agencies and programs including US African Development Foundation and Green Mini Grids (GMG) Facility Kenya. Most mini-grids being developed in Kenya are funded in part by donor grants. Here, the grant component that is included is a connection subsidy of $500 US per connection.[1] The subsidy is spread evenly along the time dimension as follows:

- First 3 years for 22 kW and 44 kW systems
- First 4 years for 88 kW system

Additionally, surcharges to the tariff are included on the backend of the tariff model outputs. These surcharges are a 5% REP levy and a 16% consumer VAT (distinct from the 16% producer VAT on CAPEX). The KES 3 cents per kWh ERC levy is also included in this analysis.

2. Investor Appetite and Subsequent Impacts

Four mini-grid investors and funders were interviewed to gauge investor appetite for potential new investments in Kenya: African Enterprise Challenge Fund (AECF), Sun Funder, InfraCo, and Cross Boundary. Each was presented with the scenario that mini-grid developers are prohibited by the regulator to pass through the increased VAT costs and then given 4 choices of response on their likelihood to invest in the Kenyan mini-grid sector under this scenario. The potential responses include a spectrum ranging from no change in likelihood of investment to 100% decrease in likelihood of investment. The two intermediate response options were located equidistantly between the extremes at 33% and 66% likelihood.

From the interviews, one respondent stated that they would no longer be interested in investing in the Kenyan mini-grid sector and three stated that they would significantly reduce new investment in the Kenyan mini-grid sector. From the rank-order of investment appetite answers possible, it is assumed that investors with "significantly" reduced investment appetite would reduce investment by approximately two-thirds of originally intended levels (33% likelihood of investment). Likewise, the one respondent that stated they would no longer be interested in investing implies a 100% reduction in investment potential (0% likelihood of investment). Averaging the four investment appetite numbers leads to an estimated average 25% likelihood of investment. In other words, this translates to 75% reduction from current investment expected levels.

[1] This number was derived from investor forecasts reported by the IFC: https://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/insights/africa-mini-grids

To understand the impact on future mini-grid projects in Kenya, we first need to know the total number of potential future mini-grid projects. The 2018 KNES estimates that there is potential for 38,661 household connections through 121 new mini-grids that are too far or small to be connected to the national grid, and an additional 100,000 households from intensification of existing mini-grids. These are identified in the KNES as households that can be connected through publicly funded investments. However, several independent studies argue there is much higher potential, estimating that mini grids would be the least cost option for 660,000 to 2.1 million households in Kenya.[2,3,4] The KNES identifies this upper bound (2.1 million households) as the number that would be best served by solar home systems rather than mini grids. Here, 2.1 million is included in the analysis to represent the highest development scenario where every household's electricity demand is met with a mini grid rather than a solar home system. This may not be the most likely scenario but represents the most optimistic. The lower bound (around 660,000 households) represents a more realistic number of households that can be met by mini grids through both public and private investments.

If only the KNES estimated 138,661 household connections are funded by public investment (sum of 38,661 household connections from new mini-grids and 100,000 connections from intensification of existing mini-grids), the remaining 521,000 (to 2 million households) will need to be served by privately funded mini grids, assuming no future increases in public investment levels. Realistically speaking, given their national goal of universal energy access, the Kenyan government will likely fund more than this estimated 21% of households (138,661 households out of 660,000). However, as 138,661 is the KNES reported value, it is the number used in this report. In addition, it is unlikely that there will not be future increases in public investment as assumed here; however, it is unknown what future investment scenarios may look like. As such, from the number of household connections to be served by private mini grids at status quo, the following assumptions are used to calculate forgone investment and jobs lost (section 4.1.2):

Assumption	Value	Source
Average number of connections per mini grid	185	AMDA database
Average nameplate capacity per mini grid	28.25 kW	AMDA database
Jobs per mini-grid site	36	NCI Report[5]
Average annual kWh per connection	270 kWh	NCI Report[6]
Average number of people served per connection	4[7]	Lahmeyer International report[8]
Average annual tax revenues per connection	1187 KES[9]	KNES Report[10]

[2] New Climate Institute. The role of renewable energy mini-grids in Kenya's electricity sector. November 2019. https://newclimate.org/wp-content/uploads/2019/11/The-role-of-renewable-energy-mini-grids-in-Kenya%E2%80%99s-electricity-sector.pdf

[3] Moksnes et al. (2017) Electrification pathways for Kenya – linking spatial electrification analysis and medium to long term energy planning. *Environmental Research Letters* 12. https://iopscience.iop.org/article/10.1088/1748-9326/aa7e18/meta

[4] See list of additional citations in Table 4 of New Climate Institute reference above.

[5] New Climate Institute, 2019.

[6] Ibid.

[7] Assumes 4 people per household and 1 household per connection . Source: Lahmeyer International.

[8] Lahmeyer International. Development of a Power Generation and Transmission Master Plan, Kenya Long Term Plan: 2015 - 2035. October 2016. https://kcv.co.ke/wp-content/uploads/2020/07/Kenya-PGTMP-Final-LTP-Vol-I-Main-Report-October-2016.pdf

[9] This value was calculated using the Kenyan GDP (US $70 billion), assuming 0.1% of GDP is electricity excise revenues, and with 6.2 million current KPLC connections. Source: https://www.oecd.org/tax/tax-policy/taxing-energy-use-kenya.pdf.

[10] Kenya National Electrification Strategy. 2018. https://pubdocs.worldbank.org/en/413001554284496731/Kenya-National-Electrification-Strategy-KNES-Key-Highlights-2018.pdf

		OECD Report[11]

4. Results and Discussion

4.1 Qualitative Findings

1. Developer Interviews

Developers interviewed have a total of 110 solar PV powered mini-grids sites with an average installed capacity of 20 kW connecting 13,954 customers across 8 counties. Residential, business, and institutional clients account for 83%, 13%, and 4% of this total, respectively. Their pipeline projects aim to connect 36,920 additional customers through 121 solar PV powered mini grids by 2022.

Main components of the capital expenditure are the generation assets, distribution assets, logistics/transportation and warehousing, metering and termination, site development and taxes. As percentage cost to the CAPEX, these range as shown in the Table 2 below. The new tax burden will affect 34% of all CAPEX costs.

Table 2: Ranges of CAPEX cost components as a percentage of total costs

#	Major Category	% Share
1	Generation Assets (USD)	42% - 50%
2	Distribution Assets (USD)	20% - 43%
3	Logistics, transportation, warehousing (USD)	6% - 7%
4	Metering and Termination (USD)	12% - 17%
5	Site Development (USD)	5% - 10%
6	VAT/Duties that should not have been levied	6% - 8%

Their experience in the application of the laws prior to the re-introduction of VAT has been consistent and in line with what was written in the law. Based on the interviews conducted, generation items that have been exempt from VAT include solar PV modules, batteries, inverters, and charge controllers. These are consistent across all the developers interviewed. No exempt items were wrongfully taxed. However, developers expected that battery racks, PV mounting material and DC cables should also have been exempt. Despite the re-introduction of VAT, all the developers expect to proceed with the planned projects. They will deal with new cost by either passing it to the end-consumer through an increase in connection costs of the electricity tariff or absorb the tax - which will increase the project payback period or reduce the returns. Developers project that tariffs must increase between 5% and 30% to cover costs depending on site specific considerations or the rate of return will reduce at rates between 0.5% and 2%. With such changes, developers expect that this will reduce the appetite to invest in mini grids among sponsors and financiers even further.

2. Investor Interviews

As previously mentioned, interviews were held with four potential mini-grid investors to assess their perception of the VAT and how this will affect their appetite to invest. Based on our estimates that the reintroduction of the VAT will i) increase generation CAPEX by 11-13%, ii) increase overall CAPEX roughly 5% and, iii) reduce returns by about 2.5%, we asked the investors how these changes will impact their investment approach going forward. The question provided the four answer options below:

[11] OECD. Taxing Energy Use for Sustainable Development. 2018. https://www.oecd.org/tax/tax-policy/taxing-energy-use-kenya.pdf

1) would not change your investment approach or rate of investment
2) would reduce your ability to invest in Kenyan mini-grid companies slightly
3) would reduce your ability to invest Kenyan mini-grid companies significantly
4) would mean you would not be able to invest here anymore.

Three of the investors indicated that option #3 (this action reduces their ability to invest in Kenyan mini-grid companies significantly) best explains how they would proceed while one investor indicate option #4 (this means that they will not be able to invest in Kenyan mini-grid developers anymore). The general feedback was that investing in mini grids is already challenging and this action only further diminishes the attractiveness of the sector. Even among investors that are primarily driven by social impact, the impact on the community of co-investors reduces their ability to invest.

3. Public Sector Interviews

One of the key functions of the Energy and Petroleum Regulatory Authority (EPRA) is to "*regulate generation, importation, exportation, transmission, distribution, supply and use of electrical energy with the exception of licensing of nuclear facilities*". As such, EPRA does not take positions on the impact of legal action taken by legislature or executive. At the time of the interview, EPRA had not commissioned research on the impacts of the re-introduction of VAT. It is expected though that this change will inevitably have an impact on the mini-grid tariffs depending on how the developers treat the additional cost. EPRA will consider tariff applications while taking this into consideration. The regulator applies a tariff calculation model that guides the process of approving tariff requests, and this tool factors in the impact of VAT on overall project performance. This and other considerations are being discussed under the ongoing draft mini-grid regulations review process.

The Ministry of Energy has likewise not undertaken a systematic study on the impact of VAT on the prospects of achieving universal electrification by 2022. At the time of the interviews, there were no tax exemptions provisioned for public sector solar PV mini grids. The project costs under components powered by solar PV and associated accessories under the Kenya Off-grid Solar Access Project are expected to be impacted but how these extra costs will be treated have not be finalized. It is also important to note that there are several ongoing attempts to revise the Financial Act 2020 including one led by the Kenya Renewable Energy Association (KEREA).

4.2 Quantitative Findings

1. EPRA Tariff Model

Table 3 shows the impacts of the 16% producer VAT on the cost-reflective tariff, project payback period, and project IRR for each of the 3 mini-grid sizes. Here, the connection subsidy contributes less than 1% of the total project capital cost for each of the system sizes. If costs were passed directly to the consumer through the tariff, this would lead to an increase of 4 KES/kWh regardless of mini-grid size. In terms of the payback period, this yields an increase in the period by estimated 3% to 6%. Meanwhile, this leads to a decrease in the project IRR of 2 % to 3%. In reality, the regulated tariff is much lower than the cost-reflective values listed in Table 3, so the payback period is much higher than listed and the IRR lower. As such, the payback period would likely increase more than 3-6% with the producer VAT and the project IRR would likely decrease more than 2-3%.

Table 3. VAT Impacts by System Size from EPRA Tariff Model

	44 kW		22 kW		88 kW	
	Current Costs	With VAT	Current Costs	With VAT	Current Costs	With VAT
Straight tariff based on kWh (KES/kWh)	100.66	104.62	137.2	141.16	82.16	86.12

Payback Period (Years)	5.03	5.28 (+4.97%)	5.49	5.68 (+3.46%)	4.74	5.01 (+5.7%)
Project IRR (%)	14.88%	14.43% (-3.02%)	13.92%	13.6% (-2.3%)	15.07%	14.58% (-3.25%)

The impacts of the producer VAT on real tariffs, electricity consumption, and tax revenue are shown in Table 4. The columns present a range of existing tariffs in Kenya (without producer VAT): the estimated minimum (54.95 KES/kWh) and maximum (93.41 KES/kWh) tariffs for privately owned mini grids.[12] Assuming all of the added costs get passed to the consumer, the new tariff with producer VAT is calculated using the estimated 4 KES/kWh increase in tariff from Table 3. The percent change in tariff is 5-9% for private MG tariffs. For households using privately-owned mini-grids, demand is expected to decrease between 4% and 6.5%. The decrease in electricity demand (change in average revenue per user) is expected to cost the country 15-55 KES/person/month. This assumes a demand elasticity of -0.9 for electricity.

In terms of the government tax revenue, there is potential for significant losses as well, due to decreased consumer VAT, REP levy, and ERC levy collected. The total potential loss in tax revenue ranges from 3.5 KES/person/month to 6.5 KES/person/month.

Table 4. Impact of 16% producer VAT on tariffs, electricity consumption, and average revenue per user

	Private MG Tariff	
Without Producer VAT (KES/kWh)	54.95	93.41
With Producer VAT (KES/kWh)	58.91	97.37
Percent Change (%)	+7.2	+4.2
Change in Electricity Demand (%)	-6.5	-3.8
Change in Average Revenue per User (KES/connection/month)	-20.35	-11.97
Lost Consumer VAT (KES/connection/month)	-3.26	-1.92
Lost REP Levy (KES/connection/month)	-1.02	-0.60
Lost ERC Levy (cents/connection/month)	-1.11	-0.38

2. Investor Appetite and Impacts

Using the assumptions discussed in section 3.1.2, the mini grids foregone from lost investment, the kilowatts lost, and the jobs lost were calculated (Table 5). A range of estimates is presented based on the lower and upper bounds of estimated connections needed by mini grids in Kenya. Recall that the upper bound represents the most optimistic scenario, where every unelectrified household's demand is met with a mini grid rather than a solar home system. This scenario represents the maximum possible impact, though it may not have the highest likelihood of occurrence. The lower bound scenario is more representative of a realistic scenario.

As can be seen, even at the lower bound, a significant number of mini-grid projects that would have otherwise been built are expected not to take place. This leads to tens of thousands of jobs lost, as well as to hundreds of millions of KES revenue lost for the government from consumer VAT and levies. As a percent of the government's annual tax revenue, 461 million KES equals 0.03% of the

[12] The *New Climate Institute* report cited previously states that the EPRA approved range of tariffs for private mini-grids is US $0.50-0.85/kWh. To determine the range in Kenyan Shillings, a conversion rate of KES 109.9 = US $1 was used.

2018 total tax revenue. This is a substantial percent and equals the annual contribution of the petroleum regulatory levy or land rent alone. At the upper bound, jobs lost, and tax revenue lost are both almost four times the estimates at the lower bound. If mini-grid investors decreased investment as they indicated in these interviews, not only would development of the off-grid sector be significantly impacted but the overall economy would feel the effects as well.

Table 5. Impact of reduced investor appetite on future mini-grid construction

	Lower Bound	Upper Bound
Connections Needed by MGs in Kenya (#)	660,000	2.1 million
Connections To Be Served by Private MGs in Kenya (#)	521,000	2 million
MGs Requiring Private Investment (#)	2,800	10,800
MGs Forgone from Lost Investment (#)	2,100	8,100
kW Lost (kW)	59,325	228,825
Connections Lost (#)	388,500	1,498,500
Jobs Lost	75,600	291,600
Tax Revenue Lost (KES)	461 million	1,778 million

This loss in tax revenue can lead to decreased government spending on health, education, security services, and environmental conservation. Kenyans in both urban and rural areas depend on the government to provide many of these services. As an example, the total health expenditure in Kenya was KES 346 billion in 2016,[13] and the potential loss in tax revenue from mini-grids is 0.1-0.5% of this expenditure. In addition to impacts on tax revenue, Kenyans in rural areas that will no longer be electrified by private mini-grid developers (due to the producer VAT) could experience delays in healthcare and education access, and more.

2. Conclusion

In 2020, the Parliament of Kenya removed a long-standing VAT exemption on specialized equipment for the development and generation of solar and reintroduced a 16% producer VAT on the CAPEX cost of PV panels, inverters, battery banks, and charge controllers. This analysis assessed the impacts of this VAT reintroduction on future electric sector development by quantifying various indicators including mini-grids foregone from lost investment, changes in the number of mini-grid connections, changes in average revenue per user, jobs lost, and tax revenue lost. Interviews with potential mini-grid investors, data from a tariff model provided by a mini-grid company, and information from existing literature were used to inform this work. Results from the tariff model analysis indicate that if mini-grid developers pass the added VAT costs onto consumers, electricity demand would decrease between 4-18% (depending on the initial tariff). In terms of lost revenue per user for mini-grid developers, this translates to 14-55 KES per connection per month. If costs are not passed onto the consumer, the added VAT costs would increase project payback periods by around 3-4 months and decrease the internal rate of return between 2-3.5%. Meanwhile, results from the investor interviews indicate substantial losses from the reintroduction of the VAT that can impact electric sector development including at least 461 million KES of tax revenue lost and 75,600 jobs lost. This is based on the low end of estimates; the impact could be much bigger. Overall, the interviews suggest that not only would development of the off-grid sector be significantly impacted, but the overall economy would be as well.

[13] Ministry of Health, Kenya. Policy Brief: A Case for Increasing Public Investments in Health Raising Public Commitments to Kenya's Health Sector. 2019. https://www.health.go.ke/wp-content/uploads/2019/01/Healthcare-financing-Policy-Brief.pdf

This analysis has two main limitations. First, the tariff model used here is assumed to be representative of a typical mini-grid in Kenya. While the distribution of costs between generation, distribution, logistics, metering, and site development were reweighted to be representative of the broader sector using AMDA data, the distribution of costs within each of these five categories (e.g., PV panels, panel trackers, inverters, panels racking, etc. within "generation assets") from the tariff model was assumed to be representative. As this data is typically confidential business information, the use of this developer-provided tariff model is the best estimate available. Second, the interview of investment appetite is primarily qualitative, with quantitative estimates being derived. For instance, this analysis assumes that the spectrum of descriptive response options about the likelihood of investment can be translated to numbers indicating 0%, 33%, 66%, and 100% likelihood. Assuming equidistant distribution of responses is the most appropriate translation here given the type of questions asked in the interviews. However, future research could include ranking and other more quantifiable potential responses that can be readily translated into investment estimates.

To better understand the impact of taxation on electric sector development, future research should also engage more developers to obtain a range of cost information, and conduct willingness-to-pay surveys about the elasticity of electricity demand.

ANNEXES

ANNEX 1: DEVELOPER INTERVIEW GUIDE

i. Background Information:
   a. Respondent name
   b. Position of respondent in the company or organization
   c. Respondent phone number
ii. Interview Details:
   . Date of Interview
iii. How many mini grid projects/sites do you currently have installed?
iv. What is the average generating capacity and the number of connections (residential, business and community facilities) of the existing mini grid sites?
v. What components were receiving VAT and duty exemptions prior to the recently enacted tax measures?
vi. What components should be exempt but incurred taxes due to inconsistencies in VAT and duty application?
vii. Have the recent tax measures affected existing projects?
   . If yes, do you plan to adjust connection fees and electricity prices to accommodate the changes?
   a. What is the likely % increase in connection fee and electricity price?
viii. How far out have you planned your mini-grid pipeline?
   . How many projects do you have planned in your pipeline?
   a. How many connections do you expect to have across all your planned projects?
ix. Do you expect to go on with the planned projects if VAT and duty tariffs are maintained?
   . If yes, how will the new VAT and duties affect your project?
x. From your perspective, how does the increased tax burden affect your ability to raise investment?
xi. From our research, mini grid capex costs typically follow the % breakdown given in the table below. For your project sites, please provide the breakdown in capital costs by equipment category:
   . Generation –
   a. Distribution –
   b. Logistics and warehousing –
   c. Metering and termination –
   d. Site development –
   e. VAT and duties –
   f. Replacement costs –
xii. Does this breakdown vary significantly by project? If so, what causes the variation? – site location, # of connections etc.
xiii. If we have brief follow-up questions, can we contact you after this interview?

Table showing the typical breakdown of mini-grid CAPEX costs.

Major Category	% Share
Generation Assets (USD)	**43%**

Generation Subcategories	% Share
PV Panels	8%
Inverter	9%
Diesel Genset	4%
Battery Bank	14%
Charge Controller	4%
Panel Mounting	5%

Distribution Assets (USD)	**22%**
Logistics, transportation, warehousing (USD)	**8%**
Metering and Termination (USD)	**17%**
Site Development (USD)	**5%**
VAT/Duties that should not have been levied	**6%**

ANNEX 2: QUESTION TO THE INVESTORS

Q: Given your experience assessing mini-grid companies in Kenya and across the continent, how would the following changes driven by the reintroduction of VAT affect your interest and ability to invest in the sector:

- Increased generation CAPEX by roughly 11-13%
- Increased overall CAPEX by roughly 5% leading to
- Developer returns reduced by about 2.5%.

Please select from the following answers:

1) would not change your investment approach or rate of investment
2) would reduce your ability to invest in Kenyan mini-grid companies slightly
3) would reduce your ability to invest Kenyan mini-grid companies significantly
4) would mean you would not be able to invest here anymore.

Please explain your answer.

ANNEX 3: QUESTIONS TO PUBLIC SECTOR STAKEHOLDERS

1. How will the VAT reintroduction impact the KOSAP (mini-grids component)? For example, do we expect to see the same number of projects and connections?
2. In your view, will the VAT reintroduction affect the universal price of grid electricity in Kenya? For example, by increasing the capex cost under the KOSAP mini-grids, and such costs passed on to electricity consumers who are cross-subsiding the tariffs.
3. How will the reintroduction of VAT affect Kenya's aim to attain universal access to electricity by 2022?
4. Do you have any suggestions on how this assignment (assessing the impacts of VAT on solar PV mini-grids) can be improved and made more responsive?