Ethiopia - Impact Assessment of Value Added Tax and Duty Exemptions

Technical Report | December 2021

Africa Clean Energy
Catalysing Africa's Solar Markets

TETRA TECH
International Development

UKaid
from the British people

Foreign, Commonwealth and Development Office (FCDO)
Africa Clean Energy Technical Assistance Facility

Tetra Tech International Development

This report was authored by the Africa Clean Energy Technical Assistance Facility.

Prosperity House, Westlands Road,
P.O. Box 4320, 00100, Nairobi, Kenya.
Tel: +254 (0)20 271 0485

Cover page: photo courtesy: www.afconsult.com. ÅF Lighting supports development project in Ethiopia

Cover page: photo courtesy: www.afconsult.com. ÅF Lighting supports development project in Ethiopia

CONTENTS

List of Figures

List of Tables

ABBREVIATIONS AND ACRONYMS

Acronym	Definition
ACE	Africa Clean Energy
ACE TAF	Africa Clean Energy Technical Assistance Facility
EAC CMA	East African Community Customs Management Act
ESEDA	Ethiopian Solar Energy Development Association
ESMAP	Energy Sector Management Assistance Program
FCDO	Foreign Commonwealth and Development Office
FTE	Full-time equivalent
GDP	Gross Domestic Product
GNI	Gross National Income
HS	Harmonised System
IEC	International Electrotechnical Commission
KEREA	Kenya Renewable Energy Association
MDCL	Market Development Credit Line
MoWE	Ministry of Water, and Energy
MTF	Multi-Tier Framework
NEP	National Electrification Program
OGS	Off Grid Solar
PAYGo	Pay As You Go
PED	Price Elasticity of Demand
PUE	Productive Use of Energy
RBF	Results Based Finance
SAS	Standalone Solar
SHS	Solar Home System
VAT	Value Added Tax

EXECUTIVE SUMMARY

Context and objectives

The Government of Ethiopia is committed to achieving universal access to energy by 2025, including 35% from off-grid energy solutions. This transition to achieving universal access by 2025 and the key role of off-grid energy solutions set out in the National Electrification Program 2.0 will mean reaching over 10 million households with off-grid energy solutions in the next five years, up from around 4 million households in 2020. While the standalone solar market has grown in the last few years, the current level of access to quality-verified SAS technologies is still relatively limited and the annual reach of quality-verified solar systems would have to increase from around 1 million units per year in 2019 and 2020 to 4 million per year by 2025.

A strong policy, regulatory and fiscal environment is essential to catalysing a vibrant SAS sector which can deliver on these energy access ambitions. Ethiopia has been an early move and leader contributing to some proactive policy and regulatory areas, such as the Development Bank of Ethiopia's credit facility for off-grid energy providers, and the adoption of national quality standards and tax exemptions as early as 2010. Nonetheless, an improved policy, regulatory and fiscal environment will be needed to unlock the pace of growth needed to achieve access to energy for all – and especially for the poorest and hardest to reach communities.

This report presents an assessment of the impact of VAT and/or customs duty exemptions on household access to SAS products in Ethiopia over the next five years. It is delivered through technical assistance provided through the UK-FCDO funded ACE TAF program and builds on a range of complementary studies on responsible taxation for the SAS sector.

Findings

Under a "policy success" scenario, up to 10 million households could be using an SAS product by 2025. This would require a highly supportive policy and regulatory environment underpinned by effectively implemented VAT and customs duty exemptions. Without the tax exemptions in place, the sector will be far less likely to scale up from the current market size and could result in at least 1.5 million fewer households gaining access to SAS technologies in the next five years.

While the exemptions would require the Government of Ethiopia to forego revenue in the short term, by catalysing growth of the SAS market this would generate an improved tax base and economic outcomes in the medium term. Full coverage of both VAT and customs duty exemptions on SAS products would mean foregoing USD 32 million in annual tax receipts in the short term but could stimulate other taxes worth USD 100 million per year and USD 280 million in annual economic benefits for households in the medium term.

Recommendations

Four main tax policy recommendations would support achievement of the Government of Ethiopia's commitment to achieving universal access to electricity as early as 2025:

1. VAT exemptions should be extended to lanterns and larger SHS (above 15Wp) and appliances that are destined for use as part of an integrated SHS, as these systems deliver the most potential for income generating opportunities.
2. Import duty exemptions should be maintained with commitment for the next five years and implementation strengthened, to give companies and investors confidence in the market.
3. The capacity and transparency of implementing agencies should be reinforced – working closely with customs agencies and officials to ensure effective application of exemptions and reduce any risk of "leakage" so non-qualifying products do not benefit.
4. Further incentives should be explored to support SAS expansion to achieve universal access through additional fiscal strategies, such as targeted results-based finance schemes.

1. INTRODUCTION

The objective of this study is to describe the potential impact of VAT and import duties on the growth of the Ethiopian standalone solar (SAS) sector and its contribution to key policy objectives and to socioeconomic development outcomes. It builds on and contributes to well-developed literature and evidence base on the importance of access to energy to drive improvement in livelihoods and economic activities, and validates the fact that a supportive enabling (i.e. policy and regulatory) environment is key to ensuring the SAS sector reaches its full potential.

This assignment is delivered through ACE TAF and builds on a range of complementary studies on responsible taxation for the SAS sector. In particular the 'ACE TAF responsible taxation tool' provides a user-friendly and flexible Excel model to estimate the impact of VAT and import duty regimes on SAS sector scaling and a range of other benefits delivered. It also draws from and complement ACE TAF deep dive studies in other countries including: (1) a retrospective analysis of VAT and import duties in Sierra Leone, (2) an analysis of a broad package of fiscal incentives in Rwanda, (3) an examination of the impact of the recent amendment to VAT and to the East African Community Customs Management Act (EAC CMA) on the SAS sector in Kenya.

The Government of Ethiopia is committed to achieving universal access to energy by 2025, including 35% from off-grid energy solutions. This means reaching over 10 million households with off-grid energy solutions in the next five years, up from around 4 million households in 2020. The remaining 19 million households will be served by the main grid, which will continue to expand after 2025 to provide access to higher energy capacity needs, and to some extent replacing or working alongside solar home systems.

The policy, regulatory and fiscal environment is a key contributor to facilitating SAS market development to achieve these energy access ambitions. The National Electrification Program 2.0 underlines Ethiopia's commitment to achieving universal access to energy including highlighting the key role of standalone solar technologies to achieve that goal in the next five years. Furthermore, various fiscal policy measures have been adopted to support the SAS market, and wider reforms to for example the telecoms sector are improving the environment for the PAYGo business to develop nationwide.

The current level of access to SAS technologies is still relatively limited and the pace of growth will need to increase to achieve the 35% access target by 2025. Sales volumes of quality-verified standalone solar products are starting to increase but will need to rise rapidly from around 1 million units per year in 2019 and 2020 to 4 million in 2025. Furthermore, most sales of SAS technologies are limited to single or multi-light systems with capacity for mobile phone charging. To unlock meaningful development impacts, the policy and regulatory environment will also need to provide the right conditions and incentives support access to larger SAS technologies that can power business applications and information technologies and thereby drive income-generating opportunities.

Ownership and multi stakeholders' coordination by MoWE. Recognizing the importance of a favourable policy, regulatory, and fiscal environment for the SAS market to reach its full potential, the Ministry of Water, and Energy (MoWE) in collaboration with ACE TAF has established a working group on fiscal incentives under the Off-Grid Task Force. The group consists of several institutions including the Ministry of Finance, Ministry of Revenue, Ethiopian Customs Commission, Ethiopian Investment Commission, Ethiopian Market Accelerator (a program supported by Shell Foundation), and the private sector represented by Ethiopian Solar Energy Development Association (ESEDA). The working group has been mandated to review existing fiscal policy on the off-grid electricity sector and its impact, on accelerating the widespread use of off-grid energy technologies such as stand-alone solar technologies which are considered as one of the major drivers for rural development and transformation. It is also expected to submit

fiscal policy recommendations that would help accelerated adoption of off-grid energy technologies and develop a customs handbook to help stakeholders clearly understand the customs clearing process, tariff classification, and duty exemptions for a range of SAS products and components.

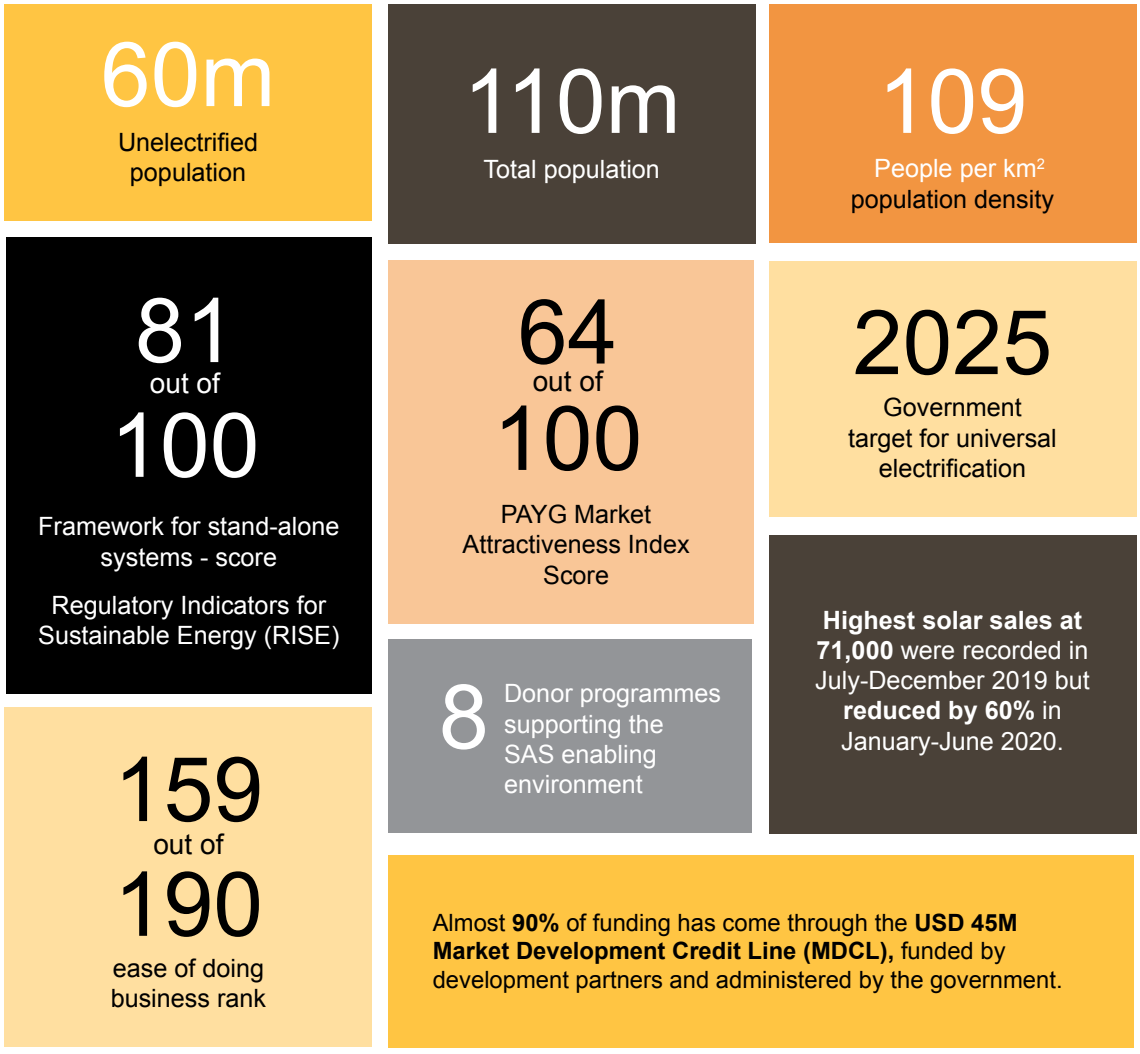
This technical report is structured as follows:

- **Section 2** describes the energy access context in Ethiopia
- **Section 3** summarises current and recent evolution of tax policy for standalone solar technologies in Ethiopia
- **Section 4** provides a brief overview of trends in tax policy for standalone solar technologies across Sub-Saharan Africa
- **Section 5** sets out the approach to developing this technical assessment
- **Section 6** presents the main results of the assessment
- S**ection 7** concludes with recommendations and next steps
- **Appendix A** provides a more detailed series of results from the assessment
- **Appendix B** includes some key references and resources

2. ETHIOPIA ENERGY ACCESS CONTEXT

The recently published ACE TAF 'Stand Alone Solar (SAS) Market Update – Ethiopia' provides a comprehensive overview of recent trends in energy access in Ethiopia.[1] We do not duplicate that analysis here, and only summarise the energy access context to frame the potential contribution of tax exemptions to unlocking achievement of policy targets and a vibrant Ethiopian economy and society, as described in the Section 6.

Figure 1: Current electrification and off-grid solar context in Ethiopia



Source: ACE TAF (2021). Stand-alone solar market update – Ethiopia

2.1 National Electrification Targets And Plans

Ethiopia's energy access targets aim for a 100% electrification rate by 2025, with 65% of this being provided by extension of the national grid. [2] To achieve this, the Government of Ethiopia plans to scale up grid connectivity from just under 7 million households in 2019 to over 19 million households by 2025.[3] To complement this, the

1 *ACE TAF (2021). Stand-alone solar (SAS) market update - Ethiopia. Link*

2 *Ministry of Water, Irrigation and Energy (2019). National Electrification Program 2.0. Figure ES.7. Link*

3 *15 million at the population size in 2019, rising to 19 million households accounting for expected population growth*

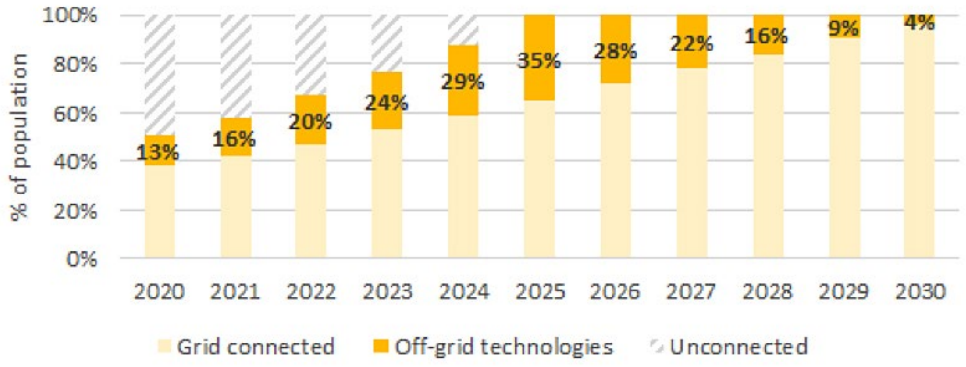
National Electricity Program 2.0 (NEP 2.0) identifies stand-alone solar (SAS) as the best technology to provide electricity to the remaining 6 million rural households currently without a grid connection in 2025. It is worth noting that the NEP 2.0 also sets out a trajectory beyond 2025 which could see the role of off-grid technologies scale back, as expansion of the main grid continues with the ambition to reach 96% of the population by 2030.

One important distinction to make in the context of the Ethiopian NEP 2.0 is the intentional transition to widescale grid expansion via off-grid energy technologies. The NEP 2.0 targets a rapid deployment of standalone solutions and mini grids to achieve universal access by 2025, which are then gradually replaced as the main grid reaches almost all households by 2030. This has two key implications for the quantitative modelling in this assignment:

- To achieve the standalone target household penetration by 2025 will require a rapid expansion of the size of the off-grid market compared to its size today. This rapid market growth is the period covered by the analysis in this report and requires the right policy and regulatory conditions to enable this rapid deployment of solar home systems.
- However, after 2025 the annual sales market may shrink, in which case the potential benefits and costs in terms of fiscal, economic, social and environmental will decrease between 2025 and 2030. This is beyond the period covered by this model, and only matters to the extent that if this aspirational scenario is achieved, then post-2025 the benefits of the SAS sector will begin to reduce (versus a scenario where SAS technologies continue to play an important role out to 2030 in which case the benefits, we present by 2025 may be to a large extent sustained in future years).

The NEP 2.0 prioritises access to energy for social services sectors (schools and hospitals) to support vulnerable groups. Whilst these institutions have higher electricity access than households, there are still 90 hospitals and 26,000 primary schools without access to electricity. The NEP 2.0 also seeks to target locations with high economic growth potential, particularly the agricultural sector. The off-grid access component is estimated to cost USD 2.5 billion, with 40% (USD 1 billion) coming from government funding and the rest from development partners and private sector resources.

Figure 2: Current electrification and off-grid solar context in Ethiopia



Source: analysis of Ethiopia NEP 2.0

2.2 Current Status and Sector Progress

Of a total population of 118 million, 61 million lacked access to electricity in 2020. Nationwide, this represents 47% of households without access to energy, compared to 36% of households which already receive power from the national grid, and a further 11% from off-grid technologies. Whilst energy access rates are improving, the majority of those that do have a connection experience frequent, unpredictable, and lengthy outages.[4] It is worth noting that while only 11% of Ethiopian households are considered to be already using an off-grid source of electricity that reaches 'Tier 1',[5] up to 24% of Ethiopian households are using off-grid solar products as their main source of

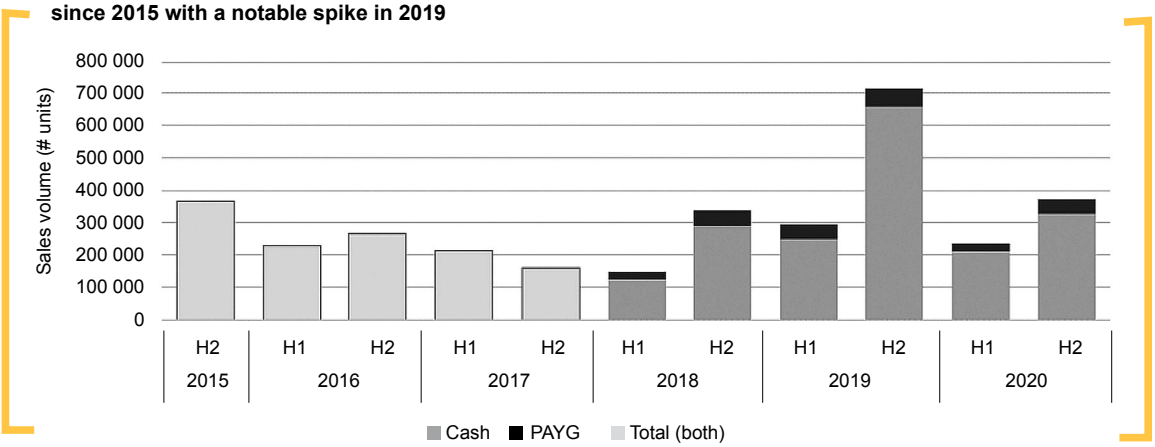
4 *Energy and Economic Growth (2020) "Moving beyond energy access – the challenge and impact of unreliable electricity in emerging economies". Link*

5 *For a full definition of the "Tier" system for categorising energy access, see ESMAP (2015) "Beyond Connections: energy access redefined". Link*

electricity – albeit the vast majority are using small solar lanterns or pico systems that are not included in the 11% 'Tier 1' access statistic.[6]

Stand-alone solar product sales have been broadly stable at 260,000 every six months. There was a notable spike in sales in the second half of 2019, with sales reverting to trend in 2020 with 235,401 units sold in the first half of the year, and 370,767 units sold in the second half of the year (Figure 2). Almost all recorded sales have been 'cash' over the counter, with very limited penetration of the PAYGo business model to date. While the half-yearly sales data do not present a stable growth path, broadly there was an uptick over the course of 2018 and 2019, potentially related to both the success of the Development Bank of Ethiopia credit facility (which offered access to hard currency to local retail companies to purchase quality verified hardware) and the improvement of importation procedures including the adoption of pre-export verification of conformity (PVoC) certificates to important quality verified products (previously products were tested in local laboratories, which resulted in delays in importation). However, in 2020 there has been a slowdown in sales, likely at least in part related to supply chain challenges caused by the COVID-19 pandemic.

Figure 3: Sales of SAS products have been relatively stable around 260,000 units every six months since 2015 with a notable spike in 2019



Source: GOGLA half-yearly sales reports

The SAS sector in Ethiopia is growing but is still far short of the growth trajectory needed to reach energy access targets. To meet the NEP 2.0 target of 10 million off-grid connections by 2025, the number of SAS end-users would have to grow by an average of 12 per cent from 1.7 million units in 2021 to 2.7 million units in 2025 (see Table 1). These targets are significantly greater than current recorded GOGLA-affiliated companies' SAS unit sales, so there is need for a significant increase in sales volumes to reach this target. There has historically been a relatively high penetration of "grey" (non-quality verified) products in Ethiopia – with the most popular being as cheap as USD3 according to IPSOS market research in 2018 – often going for less than 50 per cent of the price of a quality-verified alternative.[7]

In a price sensitive market, affordability is the main driver of sales, but low-quality products risk undermining trust in the market. The PAYGO business model helps to address affordability barriers and reduce the "price sensitivity" of demand for larger systems by spreading the cost of an SHS typically over 12 to 24 months. Furthermore, linking fiscal incentives to quality standards is an important (and now widely used internationally) policy to ensure consumers can access high quality products at an affordable price (as non-branded products cannot benefit from import duty exemptions and also cannot access formal partnerships and such as microfinance loans).

Productive use energy (PUE) technologies present major opportunities to expand production, improve efficiency and create significant new employment. PUE technologies are solar-powered systems that enable

6 *GOGLA (2019) "Ethiopia Country Brief". Link*

7 *Lighting Global (2020) "Off-Grid Solar Market Trends Report 2020", p.55 Link*

agricultural, commercial and industrial activities.[8] The use of solar energy for productive purposes is still very low in Ethiopia, but the potential for SAS systems in irrigation and agro-processing is high. The market for solar pumps in Africa is forecasted to grow by 20 per cent between 2018 and 2024, with Ethiopia potentially being the second-largest.[9] The Ethiopian Jobs Creation Commission estimates that in just the horticulture, wheat and milk value chains alone, PUE technologies can create up to 190,000 new jobs.[10] Furthermore, the Rocky Mountain Institute expects the agro-processing industry in Ethiopia to grow to an annual value of USD4 billion by 2025, the associated demand for solar products to support this industry is estimated to be USD380 million.[11]

Table 1: Indicative prices and shares of systems of different sizes

			Projected demand to meet NEP 2.0 off-grid target				
Product type	**Size**	**Unit**	**2021**	**2022**	**2023**	**2024**	**2025**
Solar lanterns	0–3Wp	Million	1.2	1.3	1.5	1.4	1.4
Pico-solar system	3–10Wp	Million	0.2	0.3	0.2	0.4	0.5
SHS	50Wp	Million	0.3	0.3	0.5	0.6	0.8
Solar pumps	600Wp	Unit	28,683	34,133	40,613	48,335	57,519
Total			**1,728,683**	**1,934,133**	**2,240,613**	**2,448,335**	**2,757,519**

Source: ACE TAF – SAS Market Update (2021)

2.3 Investment and Financing for SAS in Ethiopia

Due to a relatively restrictive regulatory environment, investment in the SAS market has been lower than some other countries in the region. Investors have deployed at least USD 52 million from 2012-2019, with a further USD 200 million committed since 2020.[12] The largest source of SAS sector financing has been the World Bank via their USD 45 million Market Development Credit Line (MDCL) which has contributed almost 90% of total investment, administered by the Development Bank of Ethiopia. The MDCL has financed at least 31 companies through the Private Sector Enterprise revolving fund, debt funding amounted to USD 18 million in 2018.[13] The MDCL has financed an additional 13 microfinance institutions, funding was USD 16.5 million in 2018. The MDCL has been deployed in multiple phases, the first phase (2012-2017) was financed USD 20 million in which 800,000 solar lanterns and 10,000 solar home systems (SHS) were approved. The second phase (2016-2018) consisted of another USD 20 million which approved over 70,000 SHS, the final phase added an additional USD 4.5 million in financing support loan collaterals for smaller SAS companies.[14]

Grant financing has also been used to support growth in the SAS sector, primarily driven by public development institutions and NGOs. The Renewable Energy and Adaptation to Climate Technologies SSA (REACT SSA) program have committed USD 6.7 million to Ethiopia in grants of between USD 100,000 and USD 1.5 million. Whilst still in its infancy, the Shell Foundation, the UK's FCDO, USAID and Belcash (an Ethiopian mobile money provider) have partnered to create Hello Solar, a SAS company operating on a PAYGo model which has sold 5,000 SHS by 2020. But these grants are very small compared to the FOREX needed to make an impact in the sector.[15]

8 *IFC (2019) "The market opportunity for productive use leverage solar energy in Sub-Saharan Africa", pp. 18. Link*

9 *Energy Market Accelerator Ethiopia (2020) "Scaling up solar pumps for irrigation and domestic water use in Ethiopia: The role of blended finance". Link*

10 *Jobs Creation Commission Ethiopia (2021) "Ethiopia: Job Creation through Off-Grid Energy Access", Link*

11 *Rocky Mountain Institute (2020) "Capturing the productive use dividend". Link*

12 *ACE TAF (2021) "Stand-alone Solar Investment Map – Ethiopia". Link*

13 *GOGLA (2019) "Ethiopia Country Brief". Link*

14 *ACE TAF (2021) "Stand-alone Solar Investment Map – Ethiopia". Link*

15 *Shell Foundation "HELLOSOLAR MARCH 2020 LEARNING REPORT", Link*

3. NATIONAL REVENUE AND TAX CONTEXT FOR THE SAS INDUSTRY

One of the most significant initiatives that aimed at supporting the expansion of the off-grid solar market in Ethiopia is the provision of customs duty tax exemption for SAS products by Ministry of Finance in 2010. The provision of tax exemptions for off-grid solar products was a key fiscal policy adopted by the Government of Ethiopia to support the expansion of the solar PV market. The scheme improved the affordability of solar products and attracted private companies in the market.

Historically, Ethiopia was one of the first African countries to link fiscal incentives with quality standards as early as 2010. The original list of solar products and technologies exempted for custom duties in 2010 included eight product categories: (1) Water pumps operating with renewable energy sources, (2) Converters / Inverters and charge controllers, (3) Solar Water Heaters, (4) Storage Batteries for renewable energy sources, (5) Solar Lanterns, (6) Solar Home Systems, (7) Solar PV Modules (8) Compact AC/ DC Florescent Lamps. Nonetheless, the exemptions only covered customs duties, with 15% VAT and 10% sur tax still imposed on solar products imported into Ethiopia. The Value-Added Tax Proclamation exempts certain items deemed essential such as food items and medicines, but solar products are not part of the exemption.

This early initiative contributed to a trend of adoption of both quality standards and fiscal incentives across the continent (some examples provided in Section 4 below). SAS products eligible for duty and tax exemption incentives were required to provide Lighting Global quality certification. Linking tax incentives with quality standards has increased the import of quality solar products and encouraged business to conduct testing and certification of solar products before they are imported.

In September 2021, GoE in collaboration with **ACE TAF updated the tax exemption provision for SAS and productive use appliances.** The objective of the revised provision was to encourage local manufacturing, accelerate the adoption of PUE technologies and expand access to rural energy health services. In addition, all products that have a duty rate of 15% or less will be exempted from sur tax (10%). The key aspects governing the new tax exemption provision included:

Products	Customs duty	Sur tax	VAT	Objective
Solar lanterns and solar home system	5%	0%	15%	To encourage local manufacturing
Solar components (e.g. invertors, batteries, charge controllers)	0%	0%	15%	To encourage importation of large system units
Selected agricultural appliances powered by solar (e.g. poultry incubators and brooders, milking machines and machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables)	0%	0%	15%	To support adoption of PUE and increase agricultural production
Selected health care equipment powered by solar (e.g. medical, surgical or laboratory sterilisers, microscopes)	0%	0%	15%	To improve rural healthcare services

However, despite the relative changes and success of this policy incentive, there are still key challenges that remain unsolved.

- **Tax restrictions on PAYGo business models limit SAS companies from designing scalable consumer financing models that address end-user affordability.**[16] With PAYGO arrangements, VAT is to be paid at the time the sale is made, irrespective of successful future payment collections from customers. This has discouraged businesses to pilot PAYGo, as the upfront VAT payment had negative impact on their cashflow and, subsequently, on their financial viability.
- **The existing off-grid environment doesn't favour productive use appliances and cross-sectoral linkages.** PUEs have the potential to accelerate increased access to modern energy services to support the GoE poverty reduction strategies. However, most productive use appliances have high customs duty rates, and it is important that key PUEs are granted tax exemptions to improve income generation activities and end poverty in rural communities in Ethiopia.
- **To support local manufacturing of SAS products, Ministry of Finance has developed a strict and limited list of qualifying products.** The list of SKD and CKD components for SAS products in which businesses are allowed to import to get duty waivers does not consider technology changes and there is no room for flexibility for businesses to improve the quality of their product. To enable local manufacturers to compete with SAS products that are imported as complete built up, it is important that the GoE adopts a product certification scheme, to ease the import process for local manufacturers.

In summary, taxation plays a crucial role in contributing to a supporting policy and regulatory environment for off-grid energy solutions in rural areas. VAT, import duties influence the price paid by consumers, and therefore the affordability of solar products. Although common concerns relate to the loss of revenue for governments, recent studies conducted in Kenya, Nigeria, Zambia and Malawi suggest that the broader socioeconomic benefits exceed the foregone tax revenues – and indeed over time can help increase the fiscal base.

PVoC (Pre-Export Verification of Conformity) is a system to ensure that prior to shipment, all imports of mandatory products comply with the Ethiopian quality standards for SAS products (ES IEC TS 62257-9-8: 2020).

Box 1: ACE TAF PVoC policy brief for Solar PV Technologies in Ethiopia

n 2021, ACE TAF developed a **Pre-export verification of conformity (PVoC) to standards for standalone solar products in Ethiopia** brief. The PVoC brief supported the Ministry of Trade and Industry to implement a program that requires importers to provide a certificate of conformity, which can be acquired from PVoC agents and can then be used for customs clearance.[17]

The key areas covered include an overview of the applicable IEC quality test standards (IEC TS 62257-9-8) and a mapping of the roles and responsibilities of the key institutions in the importation process.

16 *Jobs Creation Commission (2021). Ethiopia: Job creation through off-grid energy access.*

17 *ACE TAF (2021). Pre-export verification of conformity (PVoC) to standards for stand-alone solar products in Ethiopia.* Link

4. RECENT TRENDS IN TAX POLICIES FOR SAS TECHNOLOGIES

4.1 Contributing to the Literature on SAS and Tax Policy

This assessment contributes to a growing literature on the impact of fiscal incentives on the development of the SAS sector and delivery of socio-economic benefits. In particular, it builds on a series of studies supported by UK FCDO's Energy Africa campaign, and several studies carried out recently supported by ACE TAF (detailed in Appendix B).

These studies have found that import duty and tax exemptions have a significant impact on affordability of SAS technologies. For example, the Duke University's study of Kenya and Uganda found that a 20% import tariff would result in a decrease of 18% in the sales of solar kits without televisions. This reduced further to a 32% decrease in sales for larger capacity solar home systems (e.g. with televisions).

Alongside – and at least in part because of – the impact on affordability, tax exemptions can have a significant impact on boosting SAS market growth. For example, the Energy Africa study in Mozambique found that setting import duties and VAT at 0% could increase sales of SAS to 500,000 over a 10-year period, resulting in a 3.1 million people gaining access to standalone solar technologies. All of the studies also find a potentially significant impact on job creation, access to lighting and power for businesses and education, potential cash savings compared to traditional energy access technologies and access to information, communication, and power for income generating activities to boost livelihoods.

4.2 Trends in tax policy for SAS technologies in sub-Saharan Africa

This assessment builds on and contributes to a growing body of evidence on the impact of fiscal incentives on the development of the SAS sector and delivery of socio-economic benefits. In particular, it builds on a series of national studies supported by UK DFID's Energy Africa campaign, for Mozambique,[18] Malawi,[19] Uganda,[20] Zambia,[21] and recent further studies including a Uganda Off-Grid Energy Market Accelerator analysis of fiscal,[22] and a Duke University study of the impact of tax on uptake of SAS in East Africa.[23] The approach taken and some key findings from these studies are described in Annex 2, and briefly summarized in the box below.

Box 2: Impact of tax changes to SAS sector as shown by other studies.

Studies conducted on East Africa have found that introduction of import tariffs have a negative impact on uptake of SAS units, thus impacting the ability of governments to achieve their access targets. A Duke study of Kenya and Uganda found that a 20% import tariff would result in a decrease of 18% in the sales of solar kits without televisions. This reduced further to a 32% decrease in sales for kits with televisions.

Conversely, an ECA study on Mozambique found that setting import duties and VAT at 0% would increase projected sales of SAS to 500,000 over a 10-year period. This would result in 3.1 million people accessing power through solar PV by 2026 against a national access target of 4.1 million by 2030. Maintaining the current taxation regime would leave that number at 231,000 by 2030 (5% of the national access target).

18 *Energy Africa (2016) "Energy Africa – Mozambique. Technical assistance to model and analyse the economic effects of VAT and tariffs on pico PV products, solar home systems, and improved cookstoves". Link*

19 *Energy Africa (2017) "Energy Africa – Malawi. Technical assistance to model and analyse the economic effects of VAT and tariffs on pico PV products, solar home systems, and improved cookstoves". Link*

20 *Energy Africa (2018) "Energy Africa – Uganda. Fiscal policy options for Solar Home Systems (SHS)". Link*

21 *Kuungana Advisory (2018) "Energy Africa – Zambia. Technical assistance to model and analyse the economic effects of fiscal policy options for off-grid technologies in Zambia". Link*

22 *UOMA (2018) "Fiscal Policy Analysis: An assessment of the tax and subsidy options to accelerate solar home systems in Uganda". Link*

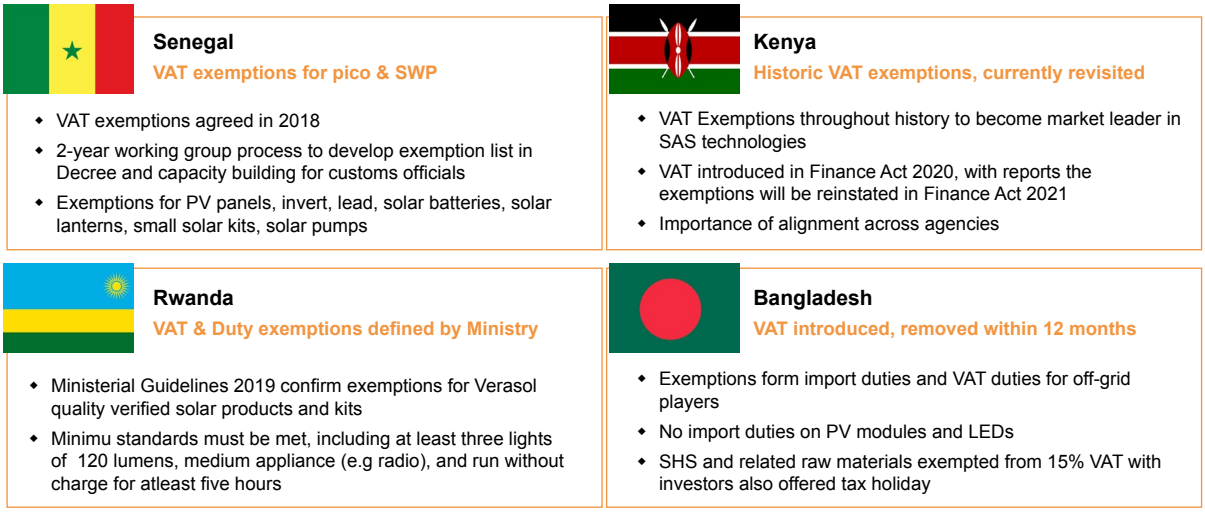
23 *Fetter, Rob, and Jonathan Phillips (2019) "The True Cost of Solar Tariffs in East Africa". Link*

VAT and import duty exemptions are a widely used – and highly successful in the right conditions – policy tool to foster development of the SAS industry. They are the most widely used fiscal tool due to their relative simplicity and low implementation cost compared to other fiscal policy tools - of 38 countries surveyed, 23 provide duty exemptions and 14 provide VAT exemptions for SAS products.[24] The world's leading off-grid solar markets have deployed tax exemptions consistently to develop their respective national markets – and indeed where taxes have been re-introduced, they have often been reversed quickly.

For example:

- In Kenya, where annual sales of SHS and solar lanterns reach around 3 million each year, and serve 30% of the rural population, VAT and import duty exemptions have been a mainstay in supporting market growth. While VAT was introduced in the Finance Act 2020, constructive engagement between KEREA (the Kenya Renewable Energy Association), the Ministry of Energy and the Ministry of Finance has resulted in the reinstating of VAT exemptions in the Finance Act 2021.
- In Rwanda where SAS sales have grown quickly in the last few years, a consistent regime of VAT and import duty exemptions is one of the key policies cited by companies as supporting their market development. Exemptions are tagged to both high quality products and IEC test standards and must also comply with the Ministry of Infrastructure guidelines which set standards for minimum system size (amongst others).[25]
- In Senegal VAT exemptions were announced in 2018, and a defined product list subsequently developed which includes entry level solar lanterns and solar home systems, and solar irrigation equipment for productive use.[26] A Technical Working Group comprising the private sector, international development partners, and key government agencies is supporting implementation of the tax codes and exemptions.
- In Bangladesh, the National Board of Revenue reintroduced VAT exemptions for solar panels and modules at the end of 2018, only a few months after VAT had been introduced.[27] Bangladesh has one of the largest SAS markets worldwide, serving 16% of the population - over 5 million households - at its peak resulting from a contribution of factors including historical VAT exemptions, and financing models that benefit the target population.

Figure 4: Tax exemptions have been a mainstay in the fastest growing SAS markets worldwide and are a widely used policy tool by governments



Source: ACE TAF analysis

24 *Bloomberg NEF, Sub-Saharan Africa Market Outlook 2020: Reducing risk, opening opportunities across the world's fastest growing regions, Climate scope, 2020, Link*

25 *MININFRA (2019) "Ministerial Guidelines on Minimum Standards for Solar Home Systems". Link*

26 *Government of Senegal (2020) "Arrêté interministériel fixant la liste des matériels destinés à la production d'énergies renouvelables exonérés de la taxe sur la valeur ajoutée." Link*

27 *https://thefinancialexpress.com.bd/trade/nbr-exempts-solar-panels-from-vat-1534493051*

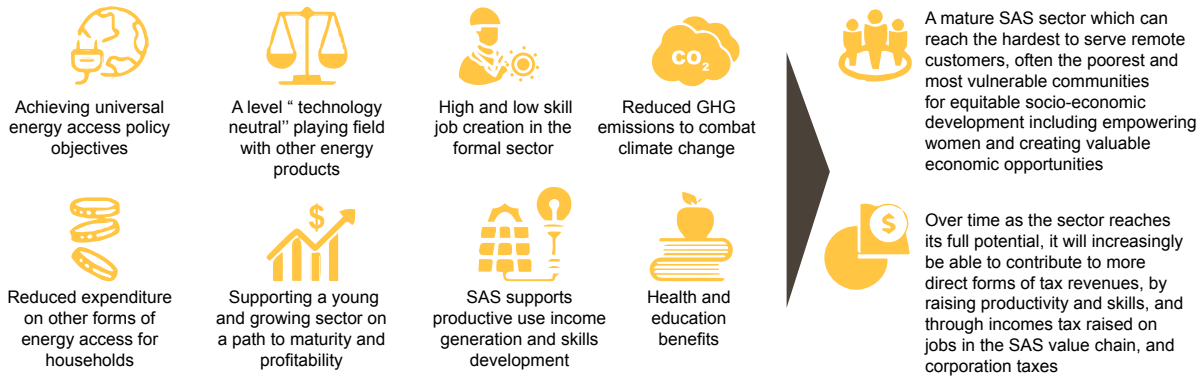
5. SUMMARY OF APPROACH

5.1 The Impact of Tax Exemptions on SAS Sector Development

While achieving universal access to energy is a worthy goal, the benefits of access to SAS technologies are wide-ranging beyond meeting the government's electrification targets. As shown from the study findings, providing fiscal incentives in support of the SAS sector supports:

- Ensuring widespread access to SAS products which offer households and small businesses access to power for productive use in and outside the household, thus improving economic income and standard of living.
- Generating crucial high and low skilled jobs in rural areas.
- Reducing household expenditure on recurring purchases of other fossil-fuel-based and often harmful forms of energy, if the relatively higher upfront cost of access to an SAS product can be overcome.
- Mitigating greenhouse gas emissions from traditional, fossil-fuel-based energy access products.
- Supporting the growth of what is still a relatively young sector to make sure businesses reach a path to maturity, reach all of their target customer base, and achieve stable profitability.
- Providing high-quality lighting and liberating time for children to spend on education at home and reducing damaging health impacts of burning fossil fuels in-doors.
- Creating a level-playing with other technologies which have historically benefited from significant public sector support and subsidies.

Figure 5: The SAS sector delivers a range of important policy, fiscal, and socioeconomic benefits that outweigh short-term gains in national revenue foregone from tax exemptions



Source: ACE TAF analysis

5.2 Model Overview

The tool to assess the impact of VAT and import duties will build on the 'ACE TAF responsible taxation multi-country' tool to provide robust analytical estimates of the impact of new tax incentives. The analysis presented here builds on the 'Standalone Solar Responsible Taxation Tool' originally developed by ACE TAF – and piloted in Malawi, Rwanda and Sierra Leone in 2020.[28] The tool has subsequently been further extended and customised to support analysis of the impact of VAT, import duties, and other fiscal incentives in Kenya,[29] Nigeria,

28 *ACE TAF (2021) "Impact of Tax Incentives on Access to Stand-Alone Solar: Policy recommendations from analysis in Malawi, Rwanda, and Sierra Leone: Report", Link*

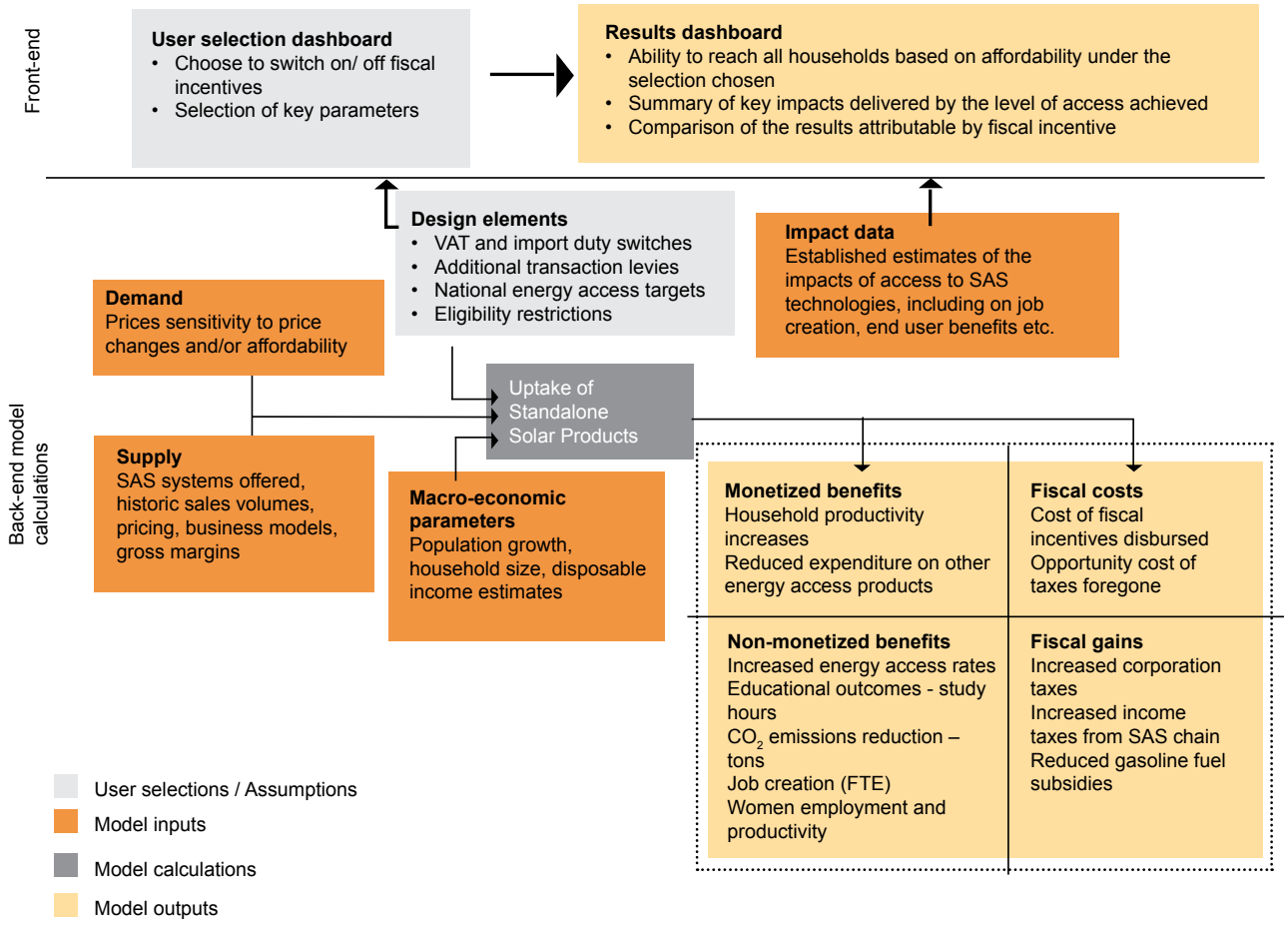
29 *ACE TAF (2021) "Exemptions on Stand-Alone Solar Products in Kenya: Technical Report", Link*

Rwanda,[30] and Sierra Leone.[31] This assignment will extend the ACE TAF model by:

- Customising it to represent the context and a range of input data and studies that reflect the context and best readily available data in Ethiopia.
- Slightly adjusting the approach to projecting SAS system future sales trajectory.
- Automating production of some key output figures and summary tables.

The structure and flow of the model are set out below in Figure 4. The model analyses the impact of VAT and import duties in line with the respective tax regimes of Ethiopia. It builds on a "policy success" trajectory to meet energy access targets, which assumes tax exemptions are in place as its starting point. It then estimates the impact of levying VAT and/or import duties on the potential for the sector to achieve this (often ambitious) "policy success" growth trajectory, and from there flows through to calculate a range of fiscal, economic, and socioeconomic and environmental outcomes.

Figure 6: Standalone Solar Responsible Tax Tool – Model Structure



Source: Model adapted for this assignment from the ACE TAF responsible taxation toolkit

30 *ACE TAF (2021) "Sierra Leone: Impact of Goods and Services Tax and Import Duty Exemptions on Stand-Alone Solar Products – Report", Link*

31 *ACE TAF (2021) "Impact Assessment of Fiscal Incentives on the Rwanda Off Grid Sector", Link*

5.3 Model Inputs and Assumptions

The model analyses the likely magnitude of relationships between tax regimes, standalone solar sector development and other outcomes. It is not intended to "predict" market evolution over the coming years, and indeed takes as its baseline an "exogenous" assumption of the potential rate of growth of the off-grid solar sector. The tables in Appendix. provide some further detail of the country-specific assumptions and data sources used.

Assumptions on the total potential off-grid solar market size:

- **Population size and potential household demand.** The population size is projected forward to estimate the total potential off-grid market, using UN population projections. Assuming household size stays constant at a national average of 4.6 then gives us a total addressable market of around 10 million households by 2025 (using the policy target described in the bullet below).
- **Sales trajectory to align to "policy success" scenario.** The model uses historic sales volumes and current penetration of SAS products to establish a present-day baseline. It then calculates the year-on-year growth trajectory that would be required to achieve national energy access objectives. This growth rate of sales assumption is based on SAS sales data from the past five years and the number of sales that would be needed to reach the national energy access target of 35% of the population using SAS technologies by 2025. The yearly SAS unit sales trajectory is shown in Appendix A and would require growth of up to 50% per year for the next five years.
- **The mix of solar products used.** Finally, we will consider the extent to which the future of the SAS in terms of product mix / ambition stays in line with current trends and prices, as per Table 2. We may want to consider alternative assumptions on the product / price mix, especially if there is a policy ambition to transition to larger capacity systems (i.e., future product sales no longer so heavily concentrated in the 0-3 Wp lantern segment)/

Table 2: Indicative prices and shares of systems of different sizes

	Plug-n-play		Component based	
Product type	**Average price (USD)**	**Share of sales**	**Average price (USD)**	**Share of sales**
0–3Wp single lighting systems	20	72%		
3–10Wp multi-light systems	60	27%		
11–20Wp small SHS	150	1%	200	35%
21–50Wp medium SHS	350	0%	475	50%
50+ Wp large SHS			650	15%

Source: ACE TAF analysis / Modelling Assumptions / Share of Sales statistics from GOGLA's half yearly sales reports as a proportion of total sales

Assumptions on the price sensitivity of the addressable off-grid solar market:

- **Ability to pay.** An affordability distribution for Ethiopia households is estimated by building a "demand" curve based only on ability to pay. This is built using (1) the shape of consumption expenditure across the population, using the World Bank PovcalNet database, (2) calibrated to reflect current income per capita (GNI). As a benchmark for affordability, the proportion of the population afford to buy a system cash over the counter, or in monthly PAYGo payments is estimated based on allocating 5% or 10% of monthly expenditure to energy access.
- **We will triangulate this approach as a robustness check to two other approaches.** First, we compare this approach to an alternative method, where instead of PovcalNet we use data on GNI and income shares by quintile to derive a similar demand curve. Second, we will compare our estimates of affordability to other published studies of ability to pay in Ethiopia, where available.

- **Price elasticity of demand (PED).** The second key modelling input is how responsive household purchases of solar systems are to a change in price – or the "price elasticity of demand". The model has functionality to take a wide range of values for the PED, based on one of two approaches:

  (1) A single price elasticity of demand for all solar products, based on the (limited) international literature. In this case, we assume the price elasticity of demand is - 0.9, with low and high scenario option of -0.56 and -1.40 respectively.[32] In the central scenario, this means that a 10% increase in price would result in a 9% fall in purchases of SHS.

  (2) The model also calculates an "affordability response" alternative to this single PED approach, as a function of ability to pay and product prices based on Ethiopia-specific data and estimating the ability to pay of households for SAS products of different sizes and prices. Table 5 in the Appendix provides an initial estimate of the resulting PEDs for four illustrative SAS products. For smaller SAS systems, the price elasticity of demand estimate is based on the ability to pay for the products using cash. For larger systems, the price elasticity of demand is based on the sensitivity of ability to pay using a pay-as-you-go model which would help to make lager systems more affordable.

Applicable border taxes on SAS products

The Standalone Responsible Tax Tool has a 'baseline' to achieve the policy ambitions with the assumption that tax exemptions are in place. It then compares this 'policy success' (or maximum market potential) to another scenario without tax exemptions (i.e., the current status quo).

The relevant national taxes that will be considered in the tool for this assignment are:

- **Customs duty of 20% on imported SAS products.** It's worth noting that in order to make solar products that are primarily used for lighting, mobile phone charging and powering small devices (e.g., radios or TV sets), more affordable in rural communities, the government has lifted the import duty on these products.
- **VAT of 15% on all solar products.** Solar products are not listed in the VAT Proclamation's item exemptions. When solar products are sold on the basis of credit, VAT is paid on the total sale price rather than the instalments. When solar products are leased, VAT is paid on the instalments due, even if not collected. When PAYGo arrangements are used, VAT is to be paid on the repayments, even when the power is yet to be fully delivered. Despite the import duty and import surcharge not being levied on specific goods, VAT still applies to all solar products.
- **Import surcharge of 5%.** This is charged on top of import duties and VAT, except for a limited number of exemptions, which now includes individual solar components to support the local assembly market but does not include any pre-assembled solar kits.

These taxes are levied sequentially, and therefore "compound". So, the VAT of 15% is paid after the import duty of 20%, and so is applied to the import price AND the import duties levied. Then the import surcharge of 5% is applied to the price of the good plus the import duty and VAT, therefore the effective tax rate is larger than the sum of the applicable individual tax rates.

For PAYGo providers and/or other consumer finance providers, these taxes also increase the need for working capital. For systems sold with a repayment plan spread over many months, the provider incurs the full cost of providing the system upfront but can only recover the revenue associated with that asset over time, meaning that they must cover this delay in cashflow through accessing working capital loans. This need is increased where taxes are paid at the point of importation but only gradually recovered from the eventual end users.

Impact assumptions, driven by annual sales volumes and total market size:

- **Corporation tax.** It is assumed that companies make limited pre-tax margins of 16% on average.[33] Margins are very low for firms in this sector worldwide, but this assumption is intended to represent where the

32 *Based on the findings of the only major structured study of price elasticity of demand in Kenya and Uganda: Duke (2019) "The True Cost of Solar Tariffs in East Africa". Link*

standalone solar sector could grow to in the next five years under accommodative conditions as companies gradually improve their profitability. Low margins mean that any increases in costs as a result of taxes levied would likely be fully passed on to consumers as businesses have limited ability to absorb these additional costs, with products typically provided close to an 'at-cost' basis. This also means that modelled gains in corporation tax are modest, but this should rise as the sector develops and margins grow. When estimating potential corporation tax contributions, we apply the current Companies Income Tax Rate of 30% on profits for Ethiopia.

- **Employment in the value chain.** The model estimates the number of jobs created in the value chain to deliver the annual sales in each tax scenario, this is primarily based on the GOGLA '*Growth Engine for Jobs*'[34] study, which provides a thorough review of the literature on job creation associated with SAS technologies worldwide. To estimate the salaries paid to workers, and the income tax contributions from workers, we assume employees are paid in line with the average national wage of USD 208 per month,[35] while senior managers may make up to three times the national average salary. We then assume workers in the value chain face an average tax rate of 10%, while managers face a higher average tax rate of 20%.
- **Educational outcomes.** The model assumes that the average household has two school aged children and gains an extra two hours of light for education in the evening. This assumption is based on the finding of a Shell Foundation study in Kenya.[36]
- **Income generation to boost livelihoods of off-grid solar households.** A share of users of solar products are expected to both (1) take up new jobs and start new businesses, and (2) become more productive and spend longer in their current jobs. The share of households that use their system to generate additional income is based on the GOGLA '*Standardised Impact Metrics for the Off-Grid Solar Sector*' report,[37] where estimates for East Africa are used and then adjusted by Ethiopia's SAS sales by system size. On this basis an estimated 13.6% of solar home system users generate an average additional income of USD 17 per month. These assumptions are also summarised in Table 3 of the Appendix.

  As we expect that much of this extra income will be generated from low-wage jobs, often in the informal sector, we do not include any increase in tax revenues associated with this increase in economic activity. However, this is a conservative assumption as some of these micro-business activities may begin to generate formal, tax-paying jobs, and the additional income earned may also be spent in the marketplace on goods which generate VAT.
- **Gross expenditure savings on other forms of energy access.** We also estimate the potential avoided expenditure on other sources of energy access. This is a "gross" saving and represents a reduction in expenditure on other energy products but does not compare this to the expenditure on solar products. The savings are estimated based on current household consumption and spending on kerosene, dry-cell batteries, candles, and small diesel or gasoline gensets.
- **Climate mitigation benefits.** We estimate the reduction in CO2 equivalent emissions from a reduction in kerosene and gasoline. We assume that 25% of households use gasoline. Meanwhile, we use the World Bank Group's 'Ethiopia – Beyond Connections MTF Framework' report to obtain estimates of alternative fuel use for kerosene, candles and battery-powered devices. For those households, at an average monthly usage of 4 litres of gasoline per household and 2 litres of kerosene. We estimate CO2 emissions on the basis of 2.5 kilogrammes of CO2 emissions per litre of kerosene consumed, and 2.3 CO2 emissions per litre of gasoline. These emissions are valued at a global social cost of carbon of USD 50 per tonne. These assumptions are summarised in Table 3 and Table 6 in the Appendix.

33 *ACE TAF (2020) "Understanding the Impact of Distribution Costs on Uptake of OGS Products in Select SSA Countries".* Link
34 *GOGLA (2019) "Off-Grid Solar: A Growth Engine for Jobs".* Link
35 *Salary Explorer (2021) "Average Salary in Ethiopia in 2021".* Link
36 *Shell Foundation (2020) "Improving the Quality of Life of Kenyan Households with Off-Grid Solar Home Systems".* Link
37 *GOGLA (2020) "Standardised Impact Metrics for the Off-Grid Solar Energy Sector".* Link
38 *World Bank Group (2018) "Ethiopia – Beyond Connections: Energy Access Diagnostic Report Based on the Multi-Tier Framework".* Link

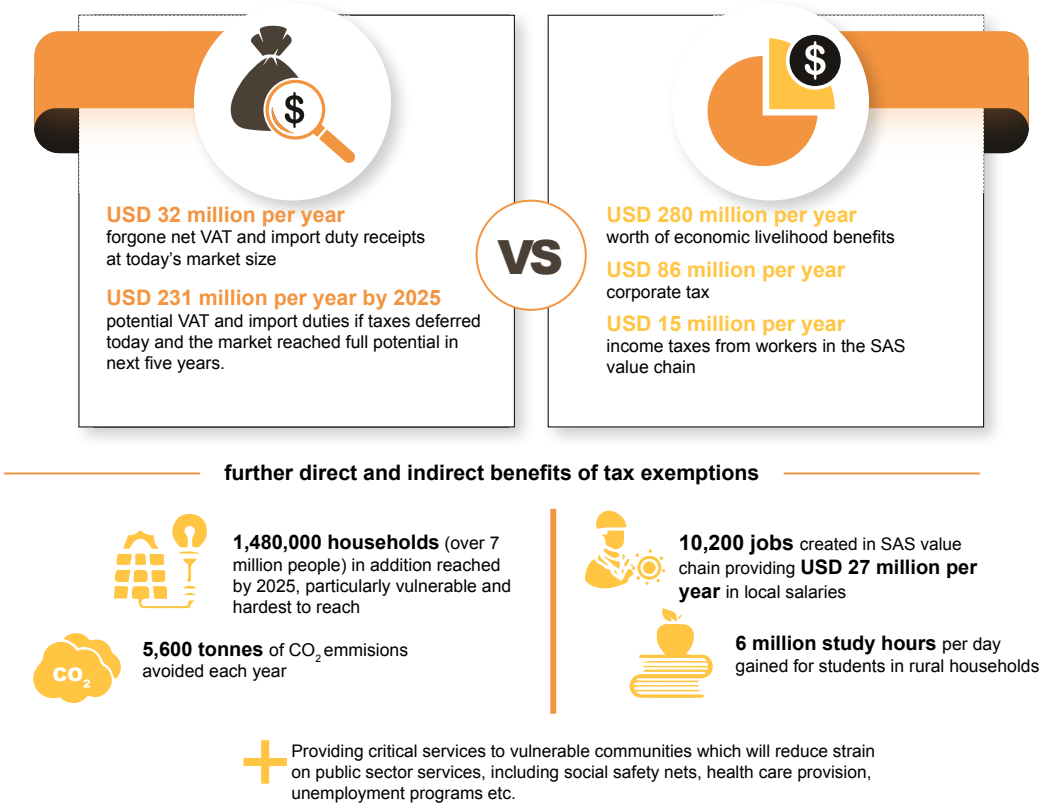
6. RESULTS

The section below presents the key results from the quantitative analysis carried out for this assessment – on the economic case for full implementation and expansion of VAT and import duty exemptions. It sets out and where possible monetizes the costs and benefits of tax exemptions, to provide a better understanding of the trade-offs of different outcomes, including fiscal, employment, household income and wider social benefits, and environmental outcomes.

Implementing VAT and import duty exemptions now while the market still has high growth potential could unlock increased national tax revenues in future. As shown in Figure 4, VAT and import duties applied at the standard rates could generate up to USD 32 million in annual tax receipts at today's market size. However, if the SAS market grows in line with its potential – and in line with the national ambition – in the next five years, then the fiscal receipts from more direct forms of taxation such as corporation tax and income taxes on employees in the solar value chain (USD 86m and USD 15m respectively) would exceed the foregone from VAT and import duty exemptions. Furthermore, if VAT and import duties are to be levied when the market conditions are right (discussed in Section 7) then they should be introduced at a time when they could generate far higher income, i.e. when the sector has matured and reached much higher sales volumes.

Furthermore, while the annual VAT and import duties foregone would represent USD 32 million, could unlock broader socioeconomic impacts worth at least USD 280 million each year. These benefits include increased productivity and income generating activities and a wider set of non-monetised benefits including the creation of up to 50,000 clean energy jobs, supporting study hours for millions of children daily, and reducing CO2 emissions by up to 40,000 tonnes per year.

Figure 7: Summary of the case for VAT and import duty exemptions



Source: ACE TAF analysis

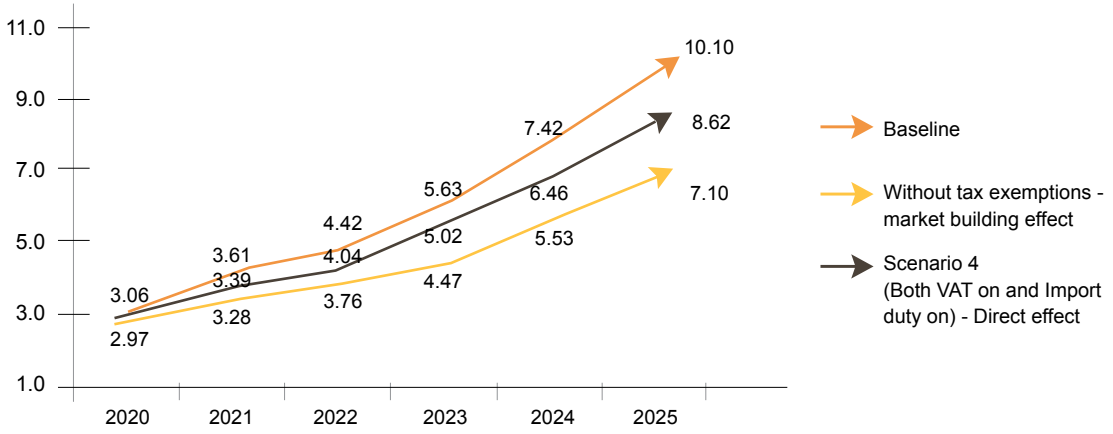
Throughout this section only the "direct" impact on energy access is presented – the impact would be larger considering the contribution of tax exemptions as part of a favourable policy and regulatory environment. The analysis in this report focuses mostly on the impact of taxes on affordability of SAS technologies and estimates how demand will respond to price changes resulting from the imposition of taxes. This is the "direct" impact of tax exemptions. However, there will also be an indirect effect – harder to quantify – in attracting SAS providers to both enter the market and scale up with confidence. VAT and import duty exemptions are a key element of this policy environment and send a clear signal to companies of a market in which they can operate and pilot products with confidence. It is not possible to isolate the role of tax exemptions in this broader policy and regulatory effect – which also includes government policy commitments to achieving energy access for all – but these "indirect" effects could be as significant as the direct impacts (and are more important at early stages of market development).

6.1 Socioeconomic Impacts by Type

Energy access and affordability

The first and most important impact of VAT and import duty exemptions is to accelerate access to energy for Ethiopian households by at least 1.5 million additional households by 2025. As shown in Figure 5, to achieve the policy goal of universal access by 2025 and 35% of households using SAS technologies, over 10 million households will need to be reached in the next five years. This is an ambitious target that will need a range of policies and incentive schemes to unlock success. Nonetheless, levying VAT and import duties on solar providers would reduce the reach of SAS products by 1.5 million households through the direct impact on prices alone. This effect is based on a price response – a "direct" impact which would be the only impact in a perfectly competitive and mature market. In addition to this, given the still relatively early stage of development of the SAS market in Ethiopia, tax exemptions also contribute to creating a favourable policy and regulatory environment which will encourage more entry into and deepening of networks, which would further accelerate the reach of standalone solar products. While this impact is less hard to assess, it could be at least as large as the "direct" price response described above.

Figure 8: Energy access scenarios with and without tax exemptions



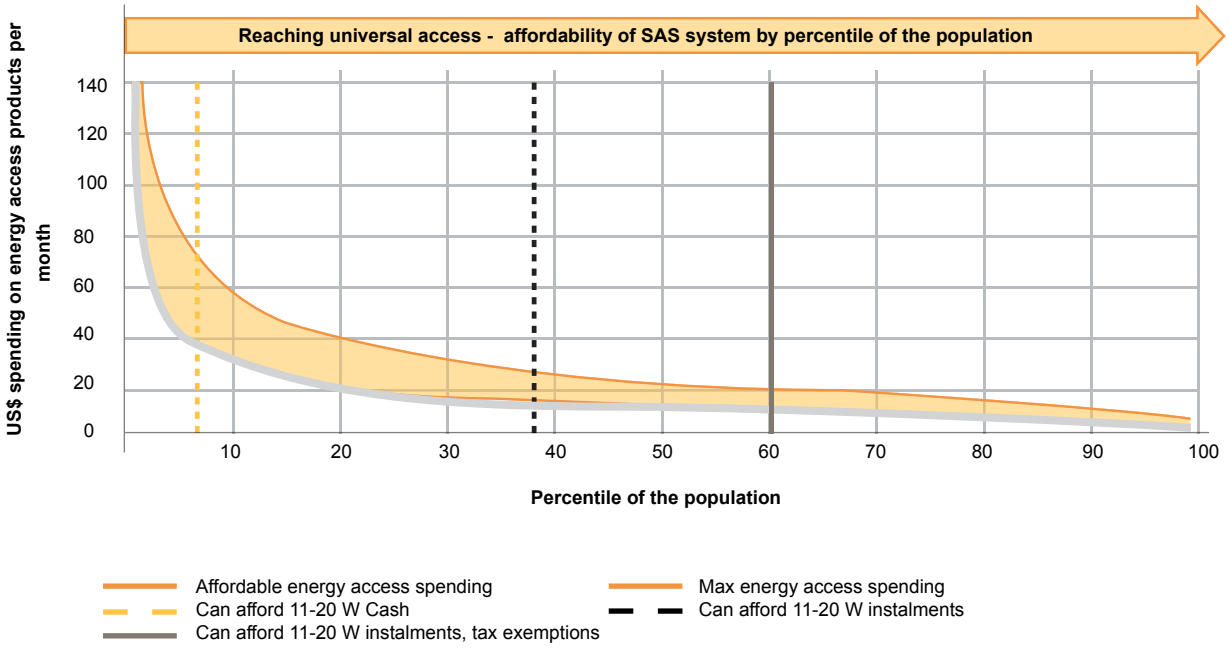
Source: ACE TAF

The most direct contribution of fiscal incentives is in making SAS systems affordable for the currently underserved – predominantly low-income – customer base. As shown in Figure 6, the vast majority (94%) of Ethiopian households nationwide would not be able to purchase a 11-20 Wp solar home system at current cash over-the-counter prices. While the PAYGo business model and/or other consumer financing models help to address this affordability challenge by spreading payments over 12 to 24 months, still around 65% of the population would not be able to afford a medium size solar home system. It is also important to note that PAYGo is not a panacea and can present other challenges for companies and households. For example, households have to manage consumer credit effectively, making long term financial commitments to repay the price of the system. For companies this

raises a risk of customer default, introduces additional transaction costs to collect payments (especially if consumer financing is cash based, not PAYGo), and also requires working capital as the company incurs the cost of providing the system upfront and only recovers these costs with a delay as the PAYGo payments are made.

In this context, VAT and import duty exemptions would boost affordability of 11-20Wp SAS products to bring them within the reach of 60% of the population. Even if the PAYGo model becomes widely available and adopted by households, this still leaves a significant tranche (40%) that will either need a combination of supply and demand side subsidies to afford an 11-20Wp basic solar home system or will be better served by smaller multi-light systems or pico lanterns. It will be important to ensure that households gain access to technologies that strike the right balance between meeting high energy needs and ambitions, with affordable products and business models that grow a sustainable market.

Figure 9: Affordability of a medium sized solar home system between 11-20 Wp capacity



Source: ACE TAF analysis

Household Income Generation and Potential Energy Savings

Access to SAS technologies could provide an annual economic boost of USD 40m per year through accelerated access to power, information and communication technologies, and appliances for households to put to productive use. As described in the modelling assumptions in Section 5, some households will have enhanced earning capabilities once they access a solar home system. Assuming 13.6% households putting their system to generate additional income – taking a conservative assumption of an extra USD 17 per month – across all SAS users by 2025 this could amount to an annual gain to the economy of around USD 280 million. This value derives from income-generating activities, such as establishing micro-enterprises such as hair salons, electricity charging services for the community, pay-per-view television, etc. SAS systems can also help local enterprises like small shops and village markets to operate during the evening. It is also worth noting that women are often the main beneficiaries of improved household energy access. Without tax exemptions in place today, this economic boost would be dampened by over USD 40 million each year.

In addition to the income gains made by some households, access to SAS products can significantly reduce spending on other, lower quality and more harmful energy sources. Once SAS products are installed, the operating and maintenance costs are relatively low, providing energy access that is near-free at the point of

consumption. However, the upfront costs are high –or may be spread using the PAYGo business model or other forms of consumer financing over up to 24 months on average. In the Ethiopian context, where many households are using cheap sources of energy access such as candles and small battery-powered torches, it is unlikely that SAS technologies will deliver significant cash savings.

Broader Social and Environmental Benefits

Access to quality lighting remains a key benefit of access to SAS products – supporting up to 2 extra study hours per day for over 20 million Ethiopian children by 2025. Solar lighting allows rural families to extend their workday into the evening hours and extends availability of light for students of all ages, and improves quality of life. Assuming lighting delivers an additional two hours of study hours per student, by 2025 over 20 million children will gain 2 hours extra study hours each day through their SAS product by 2025, helping create a skilled workforce of the future to take advantage of job opportunities. Without tax exemptions in place, at least 3 million fewer children would benefit from this study boost.

Accelerated access to SAS products would deliver significant environmental benefits, reaching up to 40,000 tonnes of CO2 emissions avoided each year by 2025. By replacing consumption of current energy access technologies – of which a significant proportion of kerosene lamps alongside candles and battery-powered torches, 40,000 tonnes of CO2 emissions could be abated each year by 2025, which would be worth USD almost USD 2 million per year (at a conservative social cost of carbon of USD 50 per tonne) and contributing towards the attainment of the government's climate target. Without the tax exemptions up to 6,000 tonnes of this benefit would not be achieved, at a cost USD 300,000 annually.

Jobs of The Present and Future in the Solar Value Chain

Creating the right enabling environment for the SAS industry to reach its full potential in the coming five years could create up to 50,000 FTE jobs. These jobs would be distributed throughout the value chain, including in rural distribution networks where jobs are much needed and would cater for a range of skilled and low-skilled employment, and increased participation in the formal economy. The salaries of these workers could be worth around USD 135 million to workers, and in the absence of VAT and import duty exemptions, 10,000 fewer jobs would be created as the sector grows more slowly, representing a loss of around USD 30 million in salaries to workers in the value chain and also reducing their potential income tax contributions (described above).

7. RECOMMENDATIONS

To unlock the potential contribution of the SAS sector in contributing to the universal access to energy target by 2025 and delivering the net fiscal and socioeconomic benefits described above will need a supported policy, regulatory, and fiscal environment. To accelerate the reach of new households accessing a quality-verified standalone solar system from under 1 million each year to the 4 million per year required to achieve the Government of Ethiopia's universal energy access target by 2025 will need a package of policy and regulatory support. Furthermore, the remaining households which do not already have access to electricity are increasingly likely to be both (1) relatively lower income, and (2) located in more remote, high-cost-to-serve locations. Providing a basic primary service such as access to energy to these communities will need not only tax incentives, but a range of other, more targeted incentive schemes (such as RBF schemes etc.)

We identify three four broad recommendations to deliver on the policy ambition and unlock the wide range of socioeconomic benefits:

Recommendation 1: Extend VAT exemptions for SAS

VAT exemptions should be extended to lanterns and larger SHS (above 15Wp) as these systems are more likely to deliver significant income generating opportunities. Similarly, appliances which can demonstrate (e.g., with a pre-verification certificate of conformity) that they are destined for use as part of an assembled standalone solar kit should also be provided. Alternatively, appliances and larger kits could be granted VAT exemptions based on a letter of approval from the Ministry or upon confirmation from the industry association ESEDA.

Recommendation 2: Maintain and strengthen the import duty exemptions.

The import duty exemptions for solar components and the 5% duty for SAS should be maintained with a commitment for at least the next five years, to give companies and investors' confidence to enter the market and scale up rapidly.

Recommendation 3: Strengthen implementation capacity and transparency

While granting exemptions is an important first step, capacity must be built with customs agencies and officials to both (1) ensure qualifying products benefit from the exemptions, and (2) to minimise and risk of leakage – i.e., non-qualifying products also benefitting from the exemptions. This can be achieved through clearly linking exemptions to both HS codes and pre-verification certificate of conformity (PVoC) processes, and/or with a responsible authority providing formal confirmation to qualifying importers. GoE should also regularly update the customs handbook for SAS and PUE to create clarity on the applicable duty, VAT and sur tax for different solar appliances and components.

Recommendation 4: Continue to support SAS expansion to achieve universal access through additional fiscal strategies.

VAT and import duty exemptions have been shown to be an effective market development tool for SAS markets worldwide. However, as the sector scales, they will not alone be sufficient to make sure no-one is left behind, and that even the most vulnerable and hardest to reach communities gain access to clean, modern and sustainable energy. As the SAS industry scales up, targeted incentives such as results-based finance conditional for example on location and/or household poverty levels should be used to support roll out of SAS technologies to the most deprived regions.

APPENDIX A – DETAILED MODELLING ASSUMPTIONS AND RESULTS

1. Model assumptions and inputs

This section provides a more in-depth summary of the assumption statistics used in the Ethiopia tailored version of the stand-alone solar responsible tax tool. The appendix is laid out as follows:

- Table 3 – Demographic, economic, environmental and social assumptions
- Table 4 – SAS product sales in 2020 and annual sales trajectory needed to reach NEP 2.0 target
- Table 5 – Price elasticity of demand of SAS products by system size and payment method
- Table 6 – Monthly expenditure on other energy sources
- Table 7 – Household monthly expenditure on income-by-income decile
- Table 8 – Share of households nationwide that can afford SAS products of different sizes either cash over the counter or with consumer finance to spread payments.

Table 3: Demographic, economic, environmental and social assumptions

Product type	Unit	Value	Source
Population size in 2020	millions	118	World Bank Population Estimates
Population size in 2025	millions	133	World Bank Population Projections
Average household size	#	4.6	Population Reference Bureau (2020) "World Population Data Sheet". Link
GNI per capita	Current USD	890	World Bank World Development Indicators
Proportion of population receiving income uplift	%	13.6%	Based on a conservative estimate from GOGLA (2020) "Standardised Impact Metrics for the Off-Grid Solar Energy Sector". Link
Monthly income uplift per household	USD	17	Based on a conservative estimate from GOGLA (2020) "Standardised Impact Metrics for the Off-Grid Solar Energy Sector". Link
Average annual salary	USD	208	Salary Explorer (2021) "Average Salary in Ethiopia in 2021". Link
Corporation tax rate	%	30%	Tax Foundation (2020) "Corporate Tax Rates around the World in 2020". Link
Average monthly use of gasoline in gensets	Litres	4	Modelling assumption (various sources)
Average monthly use of kerosene	Litres	2	Modelling assumption (various sources)
CO_2 emissions per litre of gasoline consumed	Kg	2.3	Modelling assumption (various sources)
CO_2 emissions per litre of kerosene consumed	Kg	2.5	Modelling assumption (various sources)
Social cost of carbon (per tonne)	USD	50	Modelling assumption (various sources)
Increase in hours of study per day per connection	Hours	2	Various including Shell Foundation (2020) "Improving the Quality of Life of Kenyan Households with Off-Grid Solar Home Systems". Link

Table 4: SAS product sales and sales growth needed to reach national target

Product type	Unit	Value	Source
Current access to SAS technologies (2019)	%	11	NEP 2.0
Target access to SAS technologies (2025)	%	35	NEP 2.0
Unit sales in 2020	#	606,168	GOGLA half yearly market reports
SAS product sales trajectory to meet NEP 2.0 energy target (yearly growth)	%	50*	Model calculation

Source: Analysis of GOGLA half yearly sales reports / Modelling assumptions
*Notes: * this is a significant increase in sales volumes year-on-year: potentially in part as there has been a prevalence of sales not recorded by GOGLA-affiliate members.*

Table 5: Price elasticity of demand of SAS products by system size and payment method

Product type	Main payment method	Units	Price elasticity of demand	Source
0– 3Wp lighting system	Cash	%	-0.36	Model calculation
3–10Wp multi-light system	Cash	%	-1.30	Model calculation
11–20Wp small SHS	PAYGO	%	-1.11	Model calculation
21–50Wp medium SHS	PAYGO	%	-1.31	Model calculation

Table 6: Gross expenditure savings on other forms of energy access assumptions

Product type	Units	Battery-powered devices	Candles	Kerosene lamps	Petrol/ diesel gensets	Source
Share of households using other energy access products	%	19.2%	47.0%	10.6%	0%	ESMAP MTF Beyond Connections Energy Access Diagnostic Report
Monthly household energy expenditure	USD	2.40	6.00	18.00	n/a	Modelling assumption
Proportion of spend displaced by use of SHS	%	50%	70%	60%	100%	Modelling assumption

Table 7: Household monthly expenditure on energy access by income decile (USD)

Income decile	10%	20%	30%	40%	50%	60%	70%	80%	90%
Monthly household expenditure on energy (10% of expenditure - USD)	12.44	17.23	20.40	25.08	27.77	31.28	35.34	42.48	58.34

Source: Model calculations

Table 8: Percentage of households that could afford SAS products by system size and payment method

Product type	Main payment method	Unit	Affordability (at 5% of monthly expenditure)	Affordability (at 10% of monthly expenditure)
0–3Wp lighting system	Cash*	Percentile	89%	99%
3–10Wp multi-light system	Cash*	Percentile	23%	72%
11–20Wp small SHS	Cash*	Percentile	3%	14%
21–50Wp medium SHS	Cash*	Percentile	0%	2%
11–20Wp small SHS	PAYGO**	Percentile	60%	92%
21–50Wp medium SHS	PAYGO**	Percentile	11%	50%

Source: Model calculations
** Can afford to purchase product with cash using 3 months of savings of 10% of household income*
*** Can afford to purchase product via monthly payments using 5% of household monthly income*

The intuition behind Table 8 is that the top 89% of households can afford a 0–3-Watt lighting system in cash using 3 months savings of the 10% of income households normally spend on energy access. Furthermore, the table also shows that only the top 11% of households can afford to allocate 5% of their monthly income towards paying for a 21–50-Watt medium SHS in monthly PAYGo instalments.

2. Model Result Tables

This section provides a more in-depth summary of the assumption statistics used in the Ethiopia tailored version of the stand-alone solar responsible tax tool. The appendix is laid out as follows:

- Table 9 – sets out the net impact of VAT and import duty exemptions on annual discal receipts, accounting for the effect on other forms of taxation, namely corporation tax and income taxes.
- Table 10 presents the contribution of tax exemptions if the ambition to reach 35% of households with off-grid solar technologies by 2025 is to be realised.
- Table 11 shows the potential job creation associated with tax exemptions in the next five years.
- Table 12 describes the potential annual uplift to income for users of SAS technologies, including the additional livelihood uplift unlocked by tax exemptions.
- Table 13 presents wider social and environmental benefits in terms of lighting for education and greenhouse gas emissions reductions.

Table 9: Fiscal impact of VAT and import duty exemptions – 2021 - 2025

	Unit	Value
VAT and import duty potential at current market size	USD million	-31.69
Annual fiscal receipts foregone from VAT and import duty exemptions – current	**USD million**	**-31.69**
Corporation tax (yearly) receipts at current market size	USD million	11.77
Income tax (yearly) receipts at current market size	USD million	2.05
Annual fiscal receipts gained (corp. tax and income taxes) – current	**USD million**	**13.82**
Corporation tax (yearly) receipts at 2025 potential market size	USD million	86.00
Income (yearly) receipts at 2025 potential market size	USD million	14.95
Annual fiscal receipts gained (corp. tax and income taxes) – by 2025	**USD million**	**100.95**
Potential VAT and import duties (yearly) by 2025	USD million	-231.46

Table 10: Access to SAS technologies (2021–2025)

	Unit	Value
Total number of households currently using SAS technologies	millions	2.75
Total number of households using SAS technologies under the "policy success" scenario by 2025	millions	10.10
Contribution of tax exemptions to the number of households using SAS technologies by 2025 under "policy success" scenario	millions	1.87

Table 11: Jobs in the SAS value chain – potential by 2025

	Unit	Value
Jobs created by 2025 under the "policy success" scenario	# jobs	50,090
Jobs directly attributable to tax exemptions by 2025	# jobs	10,200
Potential salaries for local workers in urban and rural value chains	USD million	134.93
Salaries attributable to tax exemptions	USD million	27.48

Table 12: Income uplift and avoided expenditure for end-users of solar technologies

	Unit	Value
Annual economic livelihood benefits to SHS users by 2025	USD million	280.12
Annual economic livelihood benefits to SHS users by 2025 directly attributable to tax exemptions	USD million	41.02
Gross reduction in annual household expenditure on other energy access technologies by 2025	USD million	405.79
Gross reduction in annual household expenditure on other energy access technologies by 2025 directly attributable to tax exemptions	USD million	59.42

Table 13: Other socioeconomic and environmental impacts

	Unit	Value
Additional study hours per day by 2025 under “policy success” scenario	# hours million	40.39
Additional study hours per day by 2025 directly attributable to tax exemptions	# hours million	5.91
CO_2 tonnes abated by 2025 under the “policy success” scenario	# tonnes	38,529
CO_2 tonnes abated by 2025 directly attributable to tax exemptions	# tonnes	5,642
Value of CO_2 abated by 2025 under the “policy success” scenario	USD million	1.93
Value of CO_2 tonnes abated by 2025 directly due to tax exemptions	USD million	0.28

APPENDIX B – USEFUL REFERENCES AND RESOURCES

ACE TAF (2021) *"Economic Impact Assessment on Removal of Tax Exemptions on Stand-Alone Solar Products in Kenya: Technical Report".* Link

ACE TAF (2021) *"Impact Assessment of Fiscal Incentives on the Rwanda Off Grid Sector".* Link

ACE TAF (2021) *"Impact of Tax Incentives on Access to Stand-Alone Solar: Policy recommendations from analysis in Malawi, Rwanda, and Sierra Leone".* Link

ACE TAF (2021) *"Impact Assessment of VAT and Import Duty Exemptions for Stand-Alone Solar in Nigeria – Technical Report".* Link

Energy Africa (2016) *"Energy Africa – Mozambique. Technical assistance to model and analyse the economic effects of VAT and tariffs on pico PV products, solar home systems, and improved cookstoves".* Link

Energy Africa (2017) *"Energy Africa – Malawi. Technical assistance to model and analyse the economic effects of VAT and tariffs on pico PV products, solar home systems, and improved cookstoves".* Link

Energy Africa (2018) *"Energy Africa – Zambia. Technical assistance to model and analyse the economic effects of fiscal policy options for off-grid technologies in Zambia".* Link

ESMAP (2018) *"Ethiopia Beyond Connections -- Energy Access Diagnostic Report Based on the Multi-Tier Framework".* Link

Energy Africa (2018) *"Energy Africa – Uganda. Fiscal policy options for Solar Home Systems (SHS)".* Link

Fetter, Rob, and Jonathan Phillips (2019) *"The True Cost of Solar Tariffs in East Africa".* Link

Power Africa (2019) *"Off-Grid Solar Market Assessment Ethiopia".* Link

Power for All et al (2021) *"Catalysing Investment for Energy Access: Making the Case for Change".* Link

Africa Clean Energy

TETRA TECH
International Development

UKaid
from the British people

ACE TAF PARTNERS INCLUDE:

WORLD RESOURCES INSTITUTE

Open Capital

teri

SOLAR SISTER

STRATEGIC PARTNER:

LIGHTING GLOBAL
Catalyzing markets for modern off-grid energy

AN INNOVATION OF WORLD BANK GROUP
THE WORLD BANK | IFC International Finance Corporation

Tetra Tech International Development

Fourth Floor, Prosperity House, Westlands Road |
PO Box 19084 – 00100 | Nairobi, Kenya.