

Energy Africa – Mozambique

Technical Assistance to model and analyse the economic effects of VAT and tariffs on picoPV products, Solar Home Systems and Improved Cookstoves



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Executive Summary

Study background and justification for tax exemptions

This study has been commissioned to analyse the costs and benefits of removal of Value Added Tax (VAT) and import duties on household energy products of considerable importance to the majority of the population of Mozambique – solar photovoltaic (PV) lanterns, solar home systems and improved cookstoves to reduce firewood and/or charcoal requirements.

In the context of the national goal of equity in access to energy, there are strong arguments in favour of Government support for these particular household energy products:

- o The Government's commitment to universal access to electricity will require at least half the population to be supplied by off-grid solar PV systems by the Sustainable Energy for All (SE4All) target date of 2030. This is because:
 - o the per connection costs of off grid electrification are only about 6% of the costs of on-grid electrification;
 - o the off-grid strategy is to leverage private sector financing, whereas on-grid electrification requires substantial public sector financing.
- o Improved cookstoves are also important, both for the beneficiary households (save money and improved health) and for national considerations of slowing deforestation and reducing CO₂ emissions.
- o The strategy for these household energy products provides an opportunity to consolidate and increase participation by Mozambican workers and local firms, thereby expanding employment and providing new impetus for local entrepreneurship. International development partners are poised to expand the assistance they have already been giving to Mozambican firms in the household energy sector.

The specific policy proposal that is analysed is for the **removal of VAT and import duties on eligible products**; that is products that meet quality standards ((Lighting Africa and International Electrotechnical Commission (IEC)) standards for solar PV and Global Alliance for Clean Cookstoves).

The formal modelling analysis shows that the fiscal cost of the tax exemptions (\$1.1 million over the 10 year exemption period) is easily exceeded by the calculated national benefits (\$7.6 million). The analysis at the national level has feedbacks and complexities:

- o direct fiscal costs to the government (foregone VAT and import duty revenue) are offset by increases in business taxes and VAT received on income spent by employees in the sector;
- o the main national socio-economic benefits that have been quantified relate to health and the environment;
- o an important benefit not directly modelled is the impact on economic growth through increased levels of activity from time savings and productivity improvements at the

household level, increased opening hours for small businesses as well as growth in the household energy supply chain.

At the household level, there will be significant **financial savings** as a result of meeting basic energy needs at a lower cost than before (\$14 million per year by 2026), as well as the benefits to households that have family members with **jobs** in the sector (2,170 employees by 2026, providing **income** of around \$4 million per year).

Development partner support to improving household energy access

The origins of this study lie in a **combined initiative** between Ministério dos Recursos Minerais e Energia (MIREME)/universities/the private sector/EnDev ((support programme managed by **Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)**). A taskforce, chaired by MIREME, was established to lobby for tax reductions, and through this, MIREME identified the need for a study to quantify the effects of tariff and VAT reductions. In preparation for its new off-grid energy programme, the United Kingdom's Department for International Development (DFID) indicated its willingness to support the study being carried out.

Several development partners are supporting the household energy sector. One of the specific upcoming support programmes that needs to be mentioned in the context of this study is the intended agreement, to be known as the '**Energy Compact**', between the Government of Mozambique (GoM) and DFID.

In anticipation of the Energy Compact being agreed in Mozambique, a £34 million (US\$ 45 million) project known as **BRILHO** has been approved by the UK government. The project, which is intended to be operational over the period 2016-2022, has a main objective of expanding market access of off-grid renewable energy products and related services to rural communities and businesses in Mozambique.

It is notable that the quantum of the BRILHO project is very large in relation to the fiscal loss, and to the overall calculated benefit of the proposed 10 year tax exemptions. This is likely to be amplified by the leveraged amount of private sector investment, which is expected to be on a matching basis, thereby bringing \$90 million into Mozambique's household energy sector.

Recommendations, advocacy and marketing

In view of the model results and related considerations summarised above, the study recommends that the GoM commit to **eliminating VAT and import duties on eligible household energy products for a 10 year period**. As already mentioned, eligibility is to be defined in terms of quality standards (details are provided in Annex A). It would be highly undesirable for the tariff reductions to result in the importation of sub-standard equipment.

The starting point in ensuring that the recommendations are speedily implemented is MIREME's commitment to working with DFID, other development partners and the private sector to advance the proposal through the various government structures that are involved in approving and implementing the proposals. An application for the customs duty waiver has already been submitted to the Autoridade Tributária de **Moçambique** (ATM) through the Confederação das Associações Económicas de **Moçambique** (CTA) on 22 July 2016. Clarification is to be sought during discussions with Ministry of Finance on whether a separate VAT submission is needed at this juncture.

The role of development partners will be to assist MIREME in formulating and articulating the arguments needed to meet the concerns of key agencies (ATM, the Ministry of Finance, the

Ministry of Industry and Trade and CTA). Concerns revolve around standards and how these are to be applied and ensuring that job creation potential is maximised.

Another important forum for advocacy of the 10 year tax exemptions will be the discussions and subsequent agreement between the Governments of Mozambique and the United Kingdom through the '**Energy Compact**'. The Energy Compact will be developed over the next few months and will include the policy and regulatory changes required to open up the market for off-grid energy (including import tariff and VAT reductions) and outline the support government and donors will provide.

1. Justification for support to the household energy sector

The Government of Mozambique's commitment to universal access to electricity

The GoM is committed to achieving universal access to electricity by 2030, the SE4All target year. The national utility, Electricidade de Moçambique (EDM) has in recent years achieved high levels of new connections of around 120,000 per year, but the geographical spread of the country and low population densities in many areas militate against the 2030 target being met through grid extension alone.

The implications of the Government's target were analysed in the recent *Energy Sector Policy Note*¹. This gives estimates of the significant costs which would have to be incurred to provide the generation, transmission and distribution infrastructure for 50% of households to be electrified via grid connections by 2030. For the Government's universal access target to be met by 2030, the other 50% of the population will have to be supplied via off-grid electrification. Updating the analysis with the latest base data for 2016², the picture is as follows:

- In 2016, Mozambique has 5.8 million households, with 24% electrified via the grid and 2% via off-grid.
- By 2030, Mozambique will have at least 8 million households. If 50% are electrified by grid extension, the remaining 4 million must have off-grid supplies if the GoM target of universal access is to be met.
- The grid extensions to provide for half the households will involve EDM accelerating the connection rate to 185,000 households per annum and raising around US\$9 billion of financing (predominantly from public sources and development assistance) for the necessary investments.
- The investment costs for 4 million off-grid electrified households are expected to be within US\$750 million, because per connection costs of off-grid (less than \$200) are only about 6% of the costs of per connection on-grid electrification as estimated for Mozambique (approximately \$3,500). In contrast to the on-grid component, the off-grid households can be supplied through private sector interventions, requiring only very small commitments of public funds. In other words, the private sector is able to offer appropriate quality off-grid energy services at prices that consumers are willing and able to pay, particularly if the capital costs are spread through pay as you go (PAYG) systems.

¹ World Bank, 2016, Annex 2.

² The assumptions used to generate the results in this section are that the 2016 population is 28.9 million, growing at 2.35% per annum, with an average household size of 5. Current on-grid households number 1.4 million, while off-grid households are 110,000.

This study has been commissioned to quantify one aspect of the 'small commitments' of public funds, namely removal of VAT and import duties, needed to leverage the resources of the private sector to provide electricity to 20 million Mozambicans (4m households) by 2030.

As is elaborated below, tax reductions have been important factors in increasing the penetration of off-grid solar photovoltaic (PV) lanterns (also known as pico-lighting) and solar home systems (SHS) in remote areas of other Sub-Saharan African (SSA) countries. This study sets out to analyse the costs and benefits of a similar approach being adopted in Mozambique, but also includes improved cookstoves, which are discussed in the next section.

The importance of efficient cookstoves

According to the Biomass Energy Strategy study, over three quarters of households in Mozambique rely on biomass (predominantly charcoal and firewood) for cooking. In the urban areas, cooking fuels are becoming a pressing concern, as the fuelwood and charcoal producing areas around the cities are becoming denuded and cooking fuel prices are rising sharply. In the rural areas, it is not so much direct financial outlays which are important, but the time spent in collecting fuel for cooking is increasing, with negative consequences for other activities.

Studies have shown that the uptake of improved cookstoves (ICS) is very limited. In a 2012 study in 3 major urban areas (Nampula, Beira and Maputo/Matola), between 85% and 92% of households had charcoal stoves, but improved stoves were only to be found in the capital and only a very small number (0.6%)³. This is despite improved cookstoves offering the potential to cut expenditure on fuel by 40%-68%, as well as reducing adverse health impacts incurred with current cooking methods. The situation may well have improved subsequently, in part as a result of programmes such as GIZ EnDev, which in the last 3 years has facilitated sales of 65,000 ICS with accelerated performance in the last 1.5 yrs.

Over 4 million stoves are still needed, and having tax exemptions could help reach more people with affordable higher quality stoves. From a national viewpoint, the widespread adoption of improved cookstoves would reduce emission of CO₂ and slow deforestation. At the current rates of biomass removal⁴, river catchments are being threatened with potentially serious consequences for water management, soil erosion and knock-on negative effects for agriculture.

Strengthening the role of local firms and creating jobs

In addition to the benefits for the bulk of the population as consumers, the strategy to provide improved household energy products is being designed to maximise the benefits for the local private sector and create employment opportunities for Mozambican workers. There are significant opportunities to import, distribute and provide back-up services for solar PV products and improved cookstoves, as well as to undertake manufacturing and assembly.

Much of this can be done by local firms and workers. However, the scale of the increase that is required to tackle the national targets implies that foreign firms, with established products and proven business models, will also need to be attracted to establish bases in Mozambique. In

³ Gilberto Mahumane (2012): Mozambique Urban Biomass Energy Analysis, UEM, 2012.

⁴ According to National Forest Inventory data, woody biomass used for cooking results in an annual deforestation rate of 219,000 ha (0.58%). Studies in particular areas show much higher rates, eg over 3% pa in the Beira Corridor (<http://www.iied.org/testing-redd-mozambique>)

respect of local manufacture and assembly, there is much more scope in improved cookstoves than in solar PV equipment.

In respect of solar PV, at the second stakeholder workshop, it was suggested that panels could be excluded from tariff reductions and instead supplied locally by the manufacturing factory owned by FUNAE. However, there are strong reasons why sole-reliance on the FUNAE factory would not be preferable. Firstly, the factory only has a capacity of 5 MWp (more if night shifts are run), which will easily be consumed by the larger solar mini-grid projects that are in the pipeline. Secondly, many solar systems are manufactured as complete kits with the panels having special electronics that help link them to the battery and control units – the panel will only work with the dedicated control unit, which helps deter panel theft. The factory panels could not be used in these systems. However, as the solar home system market grows, there will be increased opportunity for the factory to position itself as a competitive supplier of appropriate panels, particularly after the tariff reduction window ends.

The programmes supported by the development partners involved in the sector, such as GIZ, SNV and DFID, are strongly oriented towards supporting local entrepreneurship. For example:

- GIZ, as implementer of the EnDev programme in Mozambique, has supported local assembly of imported stove kits and the standardisation and scale-up of locally designed cookstoves. It has also assisted in the establishment of local picoPV firms and supporting institutions such as biomass and solar laboratories at Universidade de Eduardo Mondlane (UEM).
- SNV has assisted local household energy firms expand their market presence, and has supported a broad approach to last-mile distribution and the creation of effective channels for 'bottom of the pyramid' distribution of a variety of products.
- The role that DFID intends to play in the sector is spelt out in the next section.

2. Development partner support to improving household energy access

Development partner programmes in the sector go well beyond the support to local entrepreneurship just mentioned. This study is emblematic of this; its origins lie in a combined initiative between MIREME / UEM / the private sector / EnDev. A taskforce, chaired by MIREME, was established to lobby for tax reductions, and through this, MIREME identified the need for a study to quantify the effects of tariff and VAT reductions. In preparation for its new off-grid energy programme, DFID indicated its willingness to support the study being carried out.

This study therefore has been asked for by MIREME in response to petitioning from EnDev and the private sector companies they were working with. The different categories of stakeholder were well

represented at the two workshops held as part of the study. Attendance lists are provided in Annex B.

A specific up-coming support programme that needs to be mentioned is the intended agreement, to be known as an 'Energy Compact', between the Government of Mozambique and the United Kingdom's Department for International Development (DFID). The objectives of the agreement will likely include:

- o Creation of a regulatory framework to facilitate cheaper faster import of equipment related to renewable energies, especially for isolated solar systems (off-grid, standalone systems)
- o Creation of a legal framework and programmes aimed at supporting and protecting renewable energy consumers
- o Establishment of mechanisms to facilitate access to finance for investors of renewable energy projects (including acquisition of solar panels, inverters, charge controllers, batteries, etc., as well as marketing or operation of small solar system technologies and the transfer of technologies)
- o Promote the development of 'pay as you go' technologies for small off-grid solar systems
- o Creation of legal mechanisms for the quality testing of photovoltaic equipment against agreed standards

Energy Compacts have already been signed or are under development with other African governments. They have typically included the introduction of fiscal concessions to provide incentives for enhanced uptake of improved household energy products.

In anticipation of the Energy Compact being agreed in Mozambique, a £34 million (US\$ 45 million) project known as BRILHO has been approved by the UK government. The project, which is intended to be operational over the period 2016-2022, has as its main objective to expand market access of off-grid renewable energy products and related services to rural communities and businesses in Mozambique. One of the focus areas will be on promoting technological solutions, such as mobile phone-based pay as you go systems, to overcome the problem for households of high up-front capital costs of the equipment. BRILHO will provide support to government and non-state energy providers (private sector and NGOs) through a holistic and comprehensive set of interventions.

The BRILHO project is expected to leverage a matching amount of investment from the private sector (US\$45 million), implying a total subvention for 'base of the pyramid' household energy in Mozambique of **US\$90 million**.

3. Requested tax exemptions

At present, the population of Mozambique that is not connected to the grid is forced to rely on drycell batteries, kerosene lamps and candles for lighting. Most households use firewood and/or charcoal for cooking, but small amounts of kerosene and/or gas are also used. All of these forms of energy have negative aspects, as well as requiring high levels of expenditure. Access to affordable improved energy sources would significantly improve their quality of life while also holding the prospect of being less costly, thereby freeing up resources for either higher levels of energy consumption or other household priorities.

There is an existing GoM policy to reduce import duties and VAT on grid electrification by EDM. The target off-grid households on average are much poorer than EDM customers but they deserve the same privilege. For **household energy items meeting the quality-defined eligibility criteria**, the proposal being made is that for a period of **10 years (2017-2026)**:

- o **import duties should be set at 0%** - current values vary from 0% on imports from Southern African Development Countries (SADC) countries, to up to 20% for imports from the rest of the world, with an average (based on 2013 trade data) of about 5%.
- o **VAT should be zero rated** – a rate of 17% would otherwise apply (zero rating allows firms still to claim rebates on VAT on their inputs, which would not be the case if VAT were to be exempt on the eligible products).

At the end of 2026, the situation is to be reviewed. It is expected that a sustainable market will have been established by then and tax privileges would no longer be required.

Figure 1: Relevant harmonised code tariff lines with Most-Favoured Nation (MFN), SADC and weighted average tariff values

Heading	Item	MFN tariff	SADC tariff	Average
				2013
PV based products				
Code	Description			
850440	Static converters [eg rectifiers and inductors/inverters to convert dc to ac power]	5.0%	0.0%	2.7%
850720	Other lead-acid accumulators [Deep discharge (solar) battery]	7.5%	0.0%	2.6%
850760	Lithium-ion accumulators (excl. spent)			
851310	Portable electrical lamps designed to function by their own source of energy - lamps	20.0%	0.0%	16.5%
851319	Portable electrical lamps designed to function by their own source of energy - parts	20.0%	0.0%	7.6%
853710	Photovoltaic system controller [charge controller for voltage not exceeding 1000V]	7.5%	0.0%	4.5%
854140	Photosensitive semiconductor devices, incl. photovoltaic cells whether or not assembled or made up into panels; light emitting diodes (excl. photovoltaic generators)	7.5%	0.0%	7.2%
940550	Non-electrical lamps and lighting fittings, n.e.s.	20.0%	0.0%	8.6%
Cookstoves				
Code	Description			
732119	Cooking appliances and plate warmers, other, including appliances for solid fuel	20.0%	0.0%	12.1%
732190	Stoves etc, parts	7.5%	0.0%	4.7%

4. Approach to the analysis

Brief literature review

There have been numerous studies to evaluate the benefits of clean household energy products. These include:

- o potential savings in household energy expenditure (net of upfront costs) with more efficient cookstoves;
- o being able to use free solar energy rather than burning fuels or using batteries for lighting, as well as for charging mobile phones instead of paying a vendor;
- o health benefits from reducing indoor and ambient air pollution;
- o environmental benefits from reduced burning of traditional fuels include avoided CO₂ emissions and biomass conservation;
- o the diffusion of lighting products can potentially increase operating hours for businesses, allow for more efficient usage of time throughout the day, and increase the amount of time available for leisure or studying.

There have been a multitude of studies that have sought to quantify such effects. The job-creating benefits of renewable energy value chains relative to fuel-based energy value chains have also been noted as a significant benefit. It has been estimated that for every 10,000 off-grid households provided with alternative technology energy sources, 30 more jobs are created compared to traditional fuels.⁵ While purchasing a solar unit can temporarily raise household expenditure, the long-run impact from a study in Uganda saw energy's share of household expenditure decline from 13% to 3%.⁶ The savings for off-grid households using solar lights after completing payments ranges from \$20 to \$40 per year.⁷

SHS can provide over 2 hours of additional lighting per day, allowing for additional hours of studying by schoolchildren.⁸ ⁹ Households experiencing burns or fires can drop by 5-8% with solar energy rather than burning fuels.¹⁰

Smoky, inefficient cookstoves have a major negative impact on household health. Household air pollution due to burning fuels has been identified as the second highest risk factor in Eastern sub-Saharan Africa health.¹¹ The Global Burden of Disease 2013 study conducted by the Institute for

⁵ UNEP, 2014, 'Light and livelihood: A bright outlook for employment in the transition from fuel-based lighting to electrical alternatives'

⁶ d.Light, Idinsight, USAID, Shell Foundation, UK aid, 2016 'd.Light Solar Home System Impact Evaluation'

⁷ Lighting Global, 2016, 'Off-Grid Solar Market Trends Report'

⁸ Enea Consulting, 2012, 'Social Impact Assessment of BBOXX in Uganda'

⁹ Samad, H.A., 2013, 'The benefits of solar home systems: an analysis of Bangladesh', World Bank Policy Research Working Paper 6724.

¹⁰ d.Light, Idinsight, USAID, Shell Foundation, UK aid, 2015 'd.Light Solar Home System Impact Evaluation'

¹¹ Lim, SS., et al., 2013, 'A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study, *Lancet*, 380, 2224-60.

Health Metrics and Evaluation estimated that high household levels of fine particulate matter exposures were associated with 11,750 premature deaths and 501,700 disability-adjusted life years (DALYs) in Mozambique in 2013. Other studies have found both solar kits and improved cookstoves can improve household air quality.^{12 13}

The wider environmental impacts from improved cookstoves are less certain, but central estimates suggest modern cookstoves can reduce expected climate change-related temperature increases over the long-term.¹⁴

The increase in uptake due to reduced product prices can be significant. A forthcoming study in Kenya found that reducing the price of a solar lamp from \$7 to \$4 increased household uptake from 37% to 74%.¹⁵

Qualitative analysis of the benefits

Informed by the literature review, the approach adopted by the study team to analysing the socio-economic benefits, which might counterbalance the foregone fiscal revenues, was consider in a quantitative fashion two categories of benefit:

- **Benefits to target households**
 - **Education** – extend hours of study into the evenings, for both schoolchildren and working adults taking night education; access to new information sources through radio, TV and smartphones
 - **Health** - reduced burns, fires, respiratory problems, and/or eye problems caused by smoky, low-quality cookstoves and kerosene lamps
 - **Productivity** - reduce the time spent to collect energy sources and to utilise this time in more productive activities
 - **Quality of life** - time saved with more reliable and durable energy products can be redirected to entertainment, family, learning and leisure
 - **Financial savings** – reduced expenditure on meeting basic household energy needs – the savings can be used to consume higher levels of energy or on other household priorities
- **National benefits**
 - **New jobs** – local production and distribution of solar PV products and cookstoves is likely to increase; this will have multiplier effects on the rest of the economy

¹² Grimm, M., et al. October 2014. “A first step up the energy ladder? Low cost solar kits and household’s welfare in rural Rwanda.” IZA Discussion Paper (8594).

¹³ Hanna, R., Duflo, E., Greenstone, M, 2016, 'Up in Smoke: The influence of household behaviour on the long-run impact of improved cooking stoves', American Economic Journal: Economic Policy, 8 (1), February, 80-114.

¹⁴ World Bank, 2016 'Air pollution-related health and climate benefits of clean cookstove programs in Mozambique: A scoping analysis'

¹⁵ SolarAid, ETH Zurich, forthcoming study.

- **Deforestation will be slowed** – higher efficiency cookstoves will significantly reduce charcoal and firewood consumption
- **Carbon emissions will be reduced** – higher quality cookstoves will reduce the burning of charcoal, firewood and kerosene; solar PV products will displace fossil fuels with clean, renewable energy
- **Reduce battery disposal** – PV products will displace drycell batteries, which are difficult to safely dispose of and can have serious environmental consequences as they decompose
- **Economic growth benefits** – increased levels of activity from time savings and productivity improvements at the household level will contribute to growth, as will increased opening hours for small businesses; there will also be growth in the household energy supply chain as already noted; an additional, numerically large contribution will be from reduction in working time lost due to reduced health problems
- **New sources of national tax revenue:** the economic impact of the project will result in increased business tax and VAT on goods and services purchased as a result of increased level of economic activity and increased jobs in the supply chain. These increased taxes help to offset the foregone import duties and VAT on the household energy products

The model described below attempts to quantify key benefits, but despite its sophistication it has proved difficult to quantify them all. Therefore not all benefits are included in the model, which makes it a conservative estimate of the potential impact. If further work were done to include all benefits, this would further reinforce the positive numerical results which are presented in a later section.

Description of the model

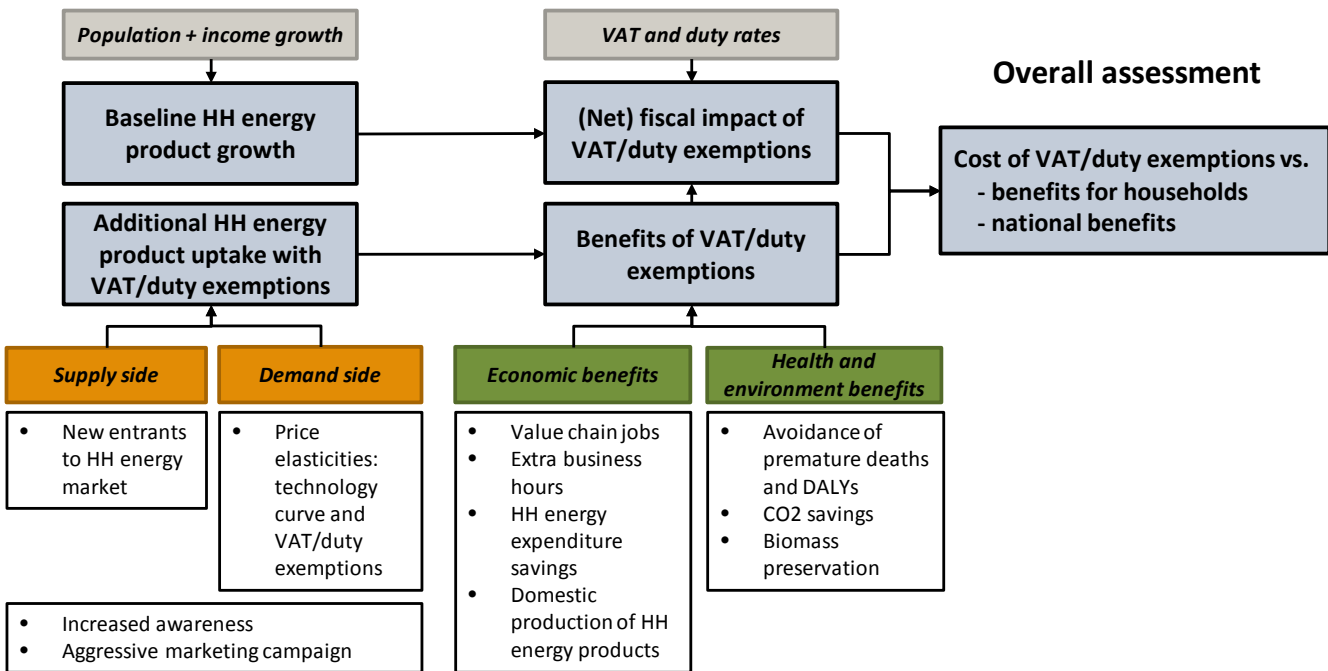
Introduction

The model is designed to measure the potential impact of making both solar PV products (pico-PV lights and solar home systems) and improved cookstoves zero rated/exempt from VAT and import duties/tariffs. A schematic of the model's inputs and outputs is shown below.

The blue boxes constitute the core of the model, which projects the growth in penetration of household energy products with and without the tax exemptions, and analyses the fiscal impact and the benefits, so that the overall assessment of the costs and benefits can be assessed. There are many assumptions that are needed, and the main categories are shown in other blocks.

The model starts with an expected "baseline" growth rate in solar PV / cookstove uptake. This baseline growth rate supposes what the uptake of the energy products would be without any government and donor-supported policy intervention. This growth rate takes into account an underlying growth in the percentage of households using clean energy products, along with the projected population growth rate. For example, for solar products in Mozambique this was based on the rate of uptake in solar products between the 2008/09 and 2014/15 national household surveys. The model also accounts for a demand-side increase in baseline uptake due to a projected decline in production costs for each product due to technological advances (the technology cost curve).

Figure 2: Schematic diagram of the cost-benefit assessment model



The model applies both a supply-side and a demand-side effect to estimate the increase in uptake brought on by VAT/duty exemptions. The supply-side increase assumes an increase in the base rate of growth of the percentage of households using solar PV products and improved cookstoves. This aims to reflect an increase in the number of suppliers entering the market, being attracted by the reduction of VAT and duties. The demand-side increase is measured by applying a demand elasticity in response to the decline in the final product price due to the reduction of VAT and duties.

Estimating the impact of the new policy on VAT and import duty revenue

The key goal of the model is to estimate the direct fiscal impact of VAT/import duty exemptions for solar PV products and improved cookstoves. The following points are to be noted on the approach:

- o **Counterfactual:** The net fiscal impact of the VAT and duty reductions only counts foregone revenue from the baseline uptake of pico-PV lights, solar homes, and improved cookstoves.
 - o This is because the counterfactual is that the additional uptake would not take place if VAT and duties are not made exempt.
 - o Mozambique would not be collecting VAT and duty revenue on *all* solar PV products and improved cookstoves, but the sales revenue from any *additional uptake would not exist otherwise*.
 - o Similarly, in measuring the benefits of the VAT/duties exemption, the model primarily counts benefits that can be attributed to the *additional* uptake in solar PV products and improved cookstoves rather than uptake as a whole. The benefits from the baseline uptake of clean energy products would occur whether the VAT/duty exemptions happen or not.

- **Domestic production:** As an additional parameter, the model assumes a growth rate in the share of pico-PV lights, SHS, and cookstoves that are produced domestically. This reduces the amount of foregone duty revenue as domestic suppliers set up operations in Mozambique, making it less dependent on imports on which it is no longer collecting duty revenue.
- **Business taxes:** The model includes a positive impact on tax revenues via increased business operating hours. A percentage of households are assumed to use their pico-PV/solar home for business purposes, and are thus able to increase their operating hours. Doing so increases business income, and the model assumes this additional income is subject to Mozambique's headline business tax rate.
- **Employment creation:** The model takes a figure from the literature that estimates the number of *additional* value chain jobs that are created by alternative energy products in comparison to traditional fuels (i.e. kerosene). The model then assumes each of these additional jobs earns the average income in Mozambique. Given such employees will still be quite poor, it is assumed that they spend all that they earn and that VAT revenue is thus charged on a proportion of this additional consumption.
- **Change in household expenditure:** Outside of the direct fiscal impact, the model also provides an estimate of the change in overall household expenditure based on savings from no longer having to burn kerosene or use disposable batteries for lighting, and solely using efficient charcoal cookstoves rather than using a mix of firewood and inefficient charcoal stoves for cooking. This is netted against the upfront cost of pico-PV lights, solar homes, and improved cookstoves (which are cheaper given the VAT/duty exemptions).
 - The model assumes that, for households that have a mobile phone, if they acquire a solar home or pico-PV light (which are both assumed to have charging sockets), they no longer need to pay vendors to charge their phones, instead using free solar energy. This figure gives an idea of the potential energy expenditure savings for households that the additional uptake of clean household energy products can bring.

Estimating the indirect benefits arising from VAT/duty exemptions

The model additionally accounts for indirect benefits to health and the environment arising from the increase in solar PV products and improved cookstoves due to the VAT/duty exemptions. The health and environmental benefits that the model accounts for include:

- **Decline in premature deaths and DALYs:** The decline in premature deaths and DALYs (after adjusting for the crude death rate) is converted to the value of the avoided loss of income per year for those who otherwise would have prematurely died or suffered DALYs. This broad estimate is based on a projected income growth rate for working Mozambicans across the time period and makes no assumptions about the age distribution of those whose health is impacted or whether they are of working age. The model implicitly assumes the societal impact of premature deaths and DALYs on the young (higher) and the old (lower) nets out to the impact of a current working-age person.
- **Decline in CO₂ emissions, conservation / preservation of biomass:** Avoided CO₂ emissions are valued via a carbon price parameter. An estimate from the literature is

taken to assign a per-hectare economic value of forest / biomass conservation. This reflects not just the intrinsic value of trees and natural vegetation, but also the economic impact of deforestation on river catchments and the availability of soils for agriculture.

Estimates for the parameters mentioned above are taken from recent health/environmental literature, Mozambique-specific estimates, or studies of other developing countries.

5. Analysis of model results

Product uptake

The graphs below illustrate the growth in household energy product uptake with and without the tax exemptions. The change is most marked in the case of solar PV products, where the policy has a big impact. In the case of cookstoves, as alluded to previously, there is already strong growth in the market for ICS, in no small measure due to continuous increases in the price of charcoal.

Figure 3: Solar PV product uptake

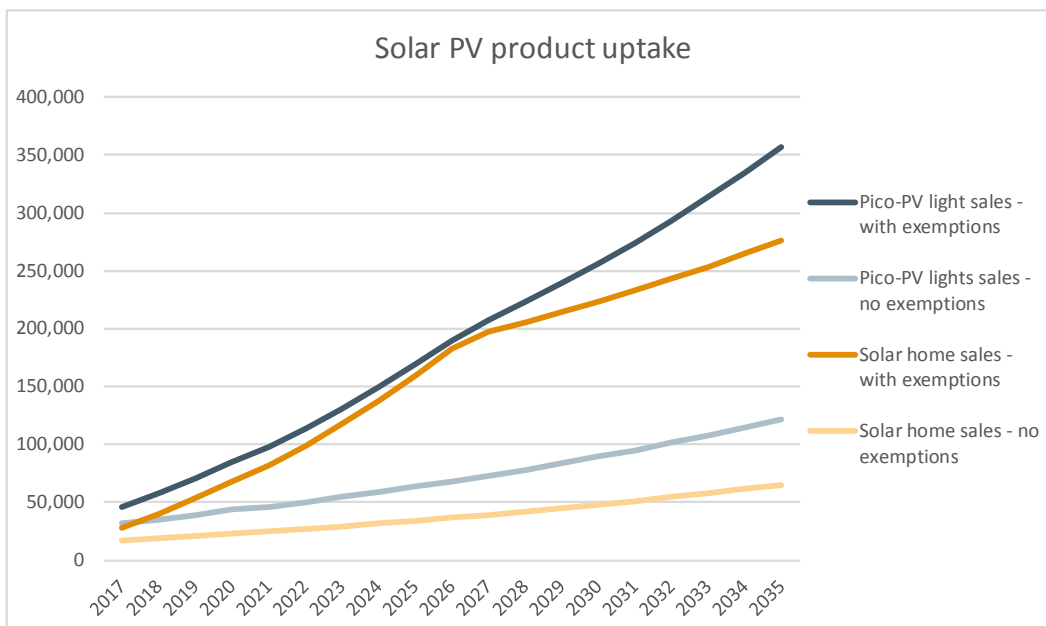
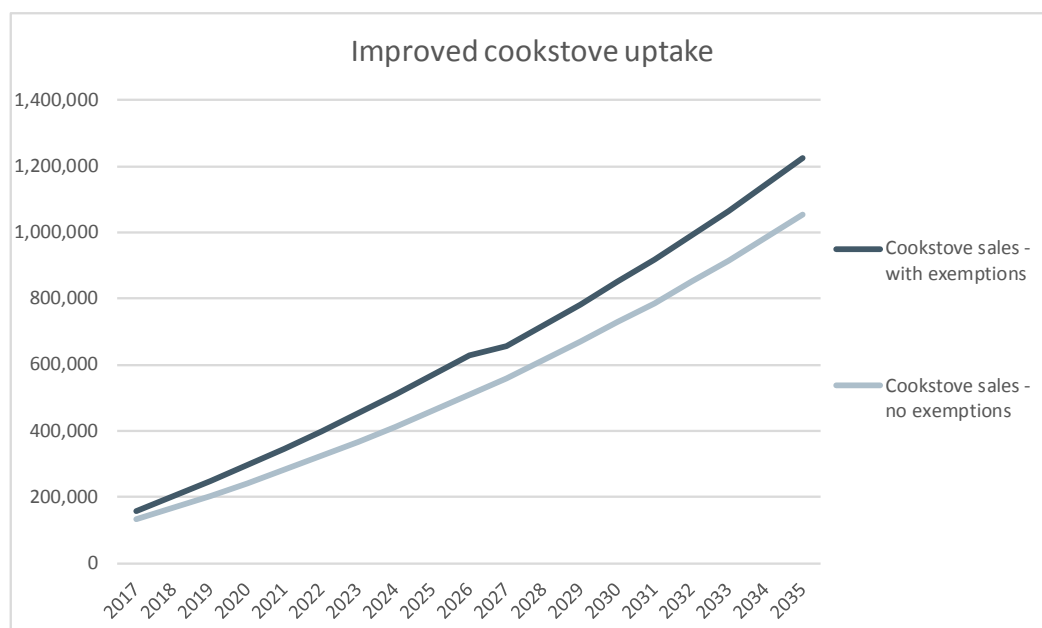


Figure 4: Improved cookstove uptake



The annual average rates of growth of SHS sales and improved cookstoves are shown in [Table 1](#) below. Over the ten year period of requested tax exemptions, the first 6 years of which would benefit from the BRILHO project interventions, sales of SHS are projected to rise to 500,000 by 2026, with benefits of SHS and solar lanterns accruing by then to over 3 million people.

Cookstove sales are similarly projected to grow to nearly 800,000 by 2026 with the tax exemptions, providing benefits again to over 3 million people. There will be some overlap in coverage, but this will be limited by solar PV products having stronger uptake in the rural areas while improved cookstoves purchases will be concentrated in the urban areas.

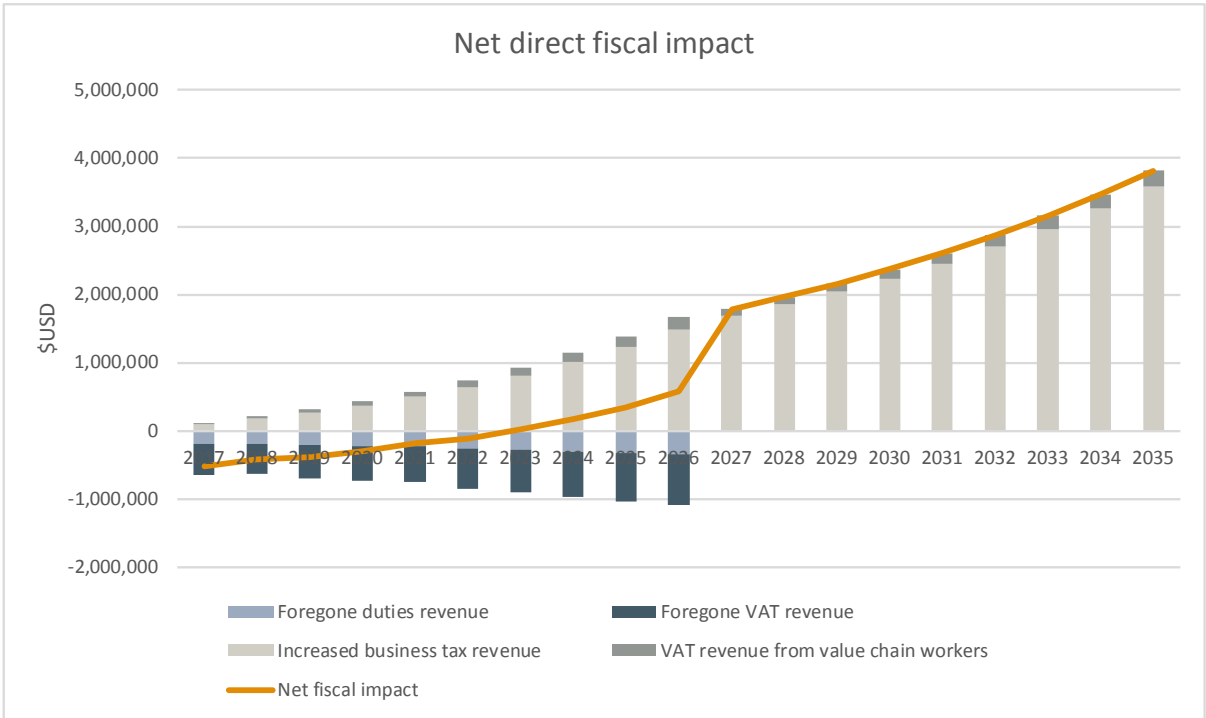
Table 1 Product uptake data 2017-2026

Impact (2017-2026)	Without new policy	With new policy
Growth rate pa SHS	8.8%	22.1%
Growth rate pa improved cookstoves	9.0%	16.1%
Households purchasing SHS 2017-2026	46,226	501,161
Households purchasing cookstoves 2017-2026	679,556	799,753
Population with access to solar PV	231,130	3,111,335
Population with improved cookstoves	2,542,707	3,143,695

Fiscal impact vs socio-economic benefits

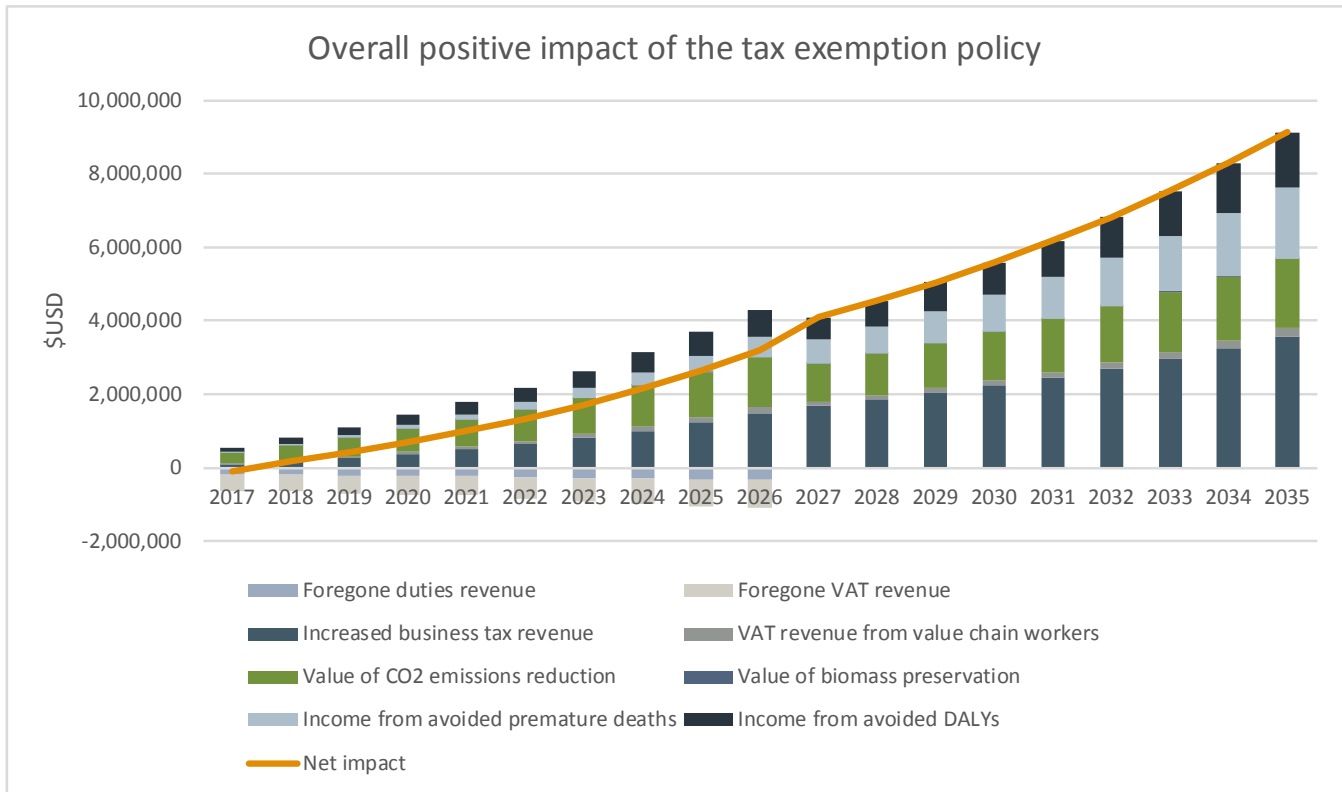
The proposal being submitted would involve zero rating VAT and setting import duties at zero. The effect of these measures would be foregone income for the ATM, but as shown in the graph this will be offset by increased business tax revenue and the VAT paid by workers in the sector. The net fiscal position is projected to be positive by the end of the BRILHO implementation period.

Figure 5: Net direct fiscal impact



The total **national impacts**, including key health and environmental benefits, are projected to be positive from the first year of the tax exemption period, and to grow rapidly thereafter. There will be a dip when VAT and import duties are restored in 2027, but the overall positive impact will continue to grow thereafter.

Figure 6: Overall positive impact of the tax exemption policy



The above graph shows the net national benefits of the proposed policy change, but as discussed earlier there are also significant benefits at the **household level**. The main benefit that has been quantified is the annual savings in the costs of meeting basic energy needs – in real terms this rises from \$4 million in 2020 to \$14 million in 2026 and \$25 million in 2035. There will be an additional 625 jobs by 2026 bringing total employment in the sector to around **2,170 jobs**, providing income of approximately \$4 million per year. These are direct employment effects – adding a national multiplier would scale employment up by at least 40% and possibly over 100%.

Further details of the balance of costs and benefits, including employment numbers, are given in [Table 2](#), where the summary values shown are net present values over the period of the tax exemptions (2017-2026). The net fiscal impact of the tax reductions equates to a loss of just \$1.1 million, while the national benefits are estimated to be \$7.6 million, giving rise to a positive value of \$6.5 million. The aggregated benefit for households is much larger, being estimated at over \$40 million over the 10 year period.

Table 2 Fiscal impact, national and household benefits (US\$ millions over 2017-2026)

Impact - US\$ millions (2017-2026)	Without new policy	With new policy
Fiscal impact	0.0	-1.1
National benefits	0.7	7.6
Overall assessment	0.7	6.5
Jobs created	1,547	2,170
Savings to be used by households	4.4	41.5

It is notable that the quantum of the BRILHO project (\$45 million) is also very large in relation to the fiscal loss, and to the overall calculated benefit. This is likely to be amplified by the leveraged amount of private sector investment. As noted previously, this should bring the total subvention for 'base of the pyramid' household energy in Mozambique to \$90 million.

6. Recommendations

The arguments in favour of the Government creating more favourable conditions for household energy products to be put into widespread use in Mozambique are compelling. For national electrification targets to be met by 2030 at least half of the population will have to be supplied through off-grid solar PV products. Support to improved cookstoves is also important for the beneficiary households as well as national considerations of slowing deforestation and reducing CO₂ emissions.

The strategy for rolling out the improved household energy products involves leveraging private sector finance, thereby minimising national financial outlays. While the scale of market development is such that foreign firms will need to be attracted to Mozambique, there is an important opportunity to consolidate and expand participation by Mozambican workers and local firms, thereby improving employment rates and providing new impetus for local entrepreneurship.

The quantified analysis, using the model, provides a strong case for the Government of Mozambique to commit to **eliminating VAT and import duties on household energy products for a 10 year period**. The factors quantified in the model show that the benefits significantly exceed the costs. Bringing to account the additional household and national benefits described earlier which have not been quantified, would reinforce this conclusion.

There is an important caveat to the recommendation, which is that the tariff reductions should only be made for products which meet **specified standards**. It would be highly undesirable for the tariff reductions to result in the importation of sub-standard equipment.

It is therefore recommended that the import duty waiver apply only to:

- Solar pico-lighting and solar home system kits that have been certified by Lighting Africa¹⁶
- Solar PV equipment which meet nominated IEC standards¹⁷
- Improved cookstove kits which are Tier 2 or higher in terms of efficiency in the Clean Cooking Catalogue of the Global Alliance for Clean Cookstoves (GACC)¹⁸.

In all cases, associated spare parts need also to be considered. Details of these standards are provided in Annex A.

¹⁶ <https://www.lightingafrica.org/new-minimum-quality-standards-become-effective-on-january-1-2014/>

¹⁷ International Electrotechnical Commission http://www.iec.ch/renewables/solar_power.htm

¹⁸ <http://cleancookstoves.org/technology-and-fuels/standards/>

7. Advocacy and marketing strategy

The objective of this section of the report is to outline the steps that are required to ensure the recommendations are adopted and promptly implemented.

The starting point is MIREME's commitment to working with DFID, other development partners and the private sector to advance the proposal through the various government structures that are involved in approving and implementing the proposed 10 year elimination of VAT and import duties on eligible household energy products.

The role of the development partners is to assist MIREME in formulating and articulating the arguments needed to meet the concerns of key agencies involved. The relevance and national justification for the proposed policy change (the first row of the table below) were strongly endorsed at the workshop. The remaining issues, which were raised in discussions at the workshop and in additional meetings afterwards, with responses and report cross-references, are summarised in the remaining rows of the table.

Agency	Issue	Response	Report Section
Ministry of Finance	Tax exemptions undermine the revenue base at a time when the budget is under extreme pressure.	The 10 year exemptions that are being requested are for the high priority area of household energy. They will directly benefit the majority of the population of Mozambique while also offering significant national benefits.	Direct fiscal impact is limited and offset by national benefits (Section 5). Report as a whole provides the necessary justification.
Department of Customs in ATM	Assurance that import duty waiver will be easy to administer, particularly in respect of identifying the eligibility of products.	In similar schemes in East Africa, application of standards requirements was not found to be difficult by the respective Customs Authorities.	Section 6 and Annex A
ATM, Ministry of Finance	Assurance that the provisions will not be a gateway for ineligible products or selective spare parts which can be used for other purposes to escape VAT and customs duties.	The standards definitions are sufficiently robust to minimise the risk of such revenue 'leakages' occurring.	Section 6 and Annex A

Agency	Issue	Response	Report Section
The Ministry of Industry and Trade and, representing the private sector, the Confederation of Economic Associations of Mozambique (CTA)	Assurance that the arrangements, particularly in respect of the importation of kits, will not displace potential job creation in manufacturing in Mozambique.	<p>This is an important concern. In the case of improved cookstoves, kits should be imported for local assembly with local content where possible. This approach is not well suited to photovoltaic products, particularly SHS, where the quality requirements necessitate the kits being delivered in assembled form.</p> <p>As the market for these off-grid products grows, particularly nearing the end of the tariff reduction window, it will make commercial sense for companies to start looking at local manufacture where possible.</p>	Section 1 – discussion on “Strengthening the role of local firms and creating jobs”

In respect of the waiver of customs duties, in order to try to have household energy products included in the current round of parliamentary deliberations, an application was submitted via CTA to ATM on 22 July 2016. This is the established channel for applications for changes in customs duties.

It is important for MIREME to enter into a dialogue with the Ministry of Finance about the customs duty application and the similar application that needs to be made for a waiver of VAT. Acceptance by the Government of Mozambique of the principle of exempting customs duties would pave the way for the corresponding removal of VAT to be affected. However, the Ministry of Finance may prefer a separate formal application to be made on VAT. Such a submission would draw on the results of this report (which were not available at the time of the customs duty submission) as well as discussing the different VAT options (as outlined in Section 3, zero rating is preferred because it would still allow firms to claim rebates on VAT on their inputs, which would not be the case if VAT were to be exempt on the eligible products).

Another important forum for advocacy of the 10 year tax exemptions will be the discussions and subsequent agreement between the Governments of Mozambique and the United Kingdom through the ‘**Energy Compact**’. The Energy Compact will be developed over the next few months and will include the policy and regulatory changes required to open up the market for off-grid energy (including import tariff and VAT reductions) and outline the support government and donors will provide.

ANNEX A: Product standards defining eligibility for tax exemptions

- **Lanternas Solares e Kits de Sistemas Solares Domésticos**
 - Lanternas Solares e Kits de Sistemas Solares Domésticos aprovados conforme IEC/TS 62257-9-5 ou Lighting-Global-Solar-Home-System-Kit-Quality-Assurance-Protocols ou UEM-Quality-Assurance-Protocols-for-Solar-Home-System-Kits, e as suas peças sobresselentes.
- **Equipamento Fotovoltaico**
 - Módulos Solares Fotovoltaicos aprovados de acordo com Standards IEC 61730 e IEC 61215 ou IEC 61646.
 - Controladores de Carga Solar aprovados de acordo com Standards IEC 62509 e IEC 62093
 - Conversores/Inversores Solares DC/AC aprovados de acordo com os Standards IEC 61683 e IEC 62109
 - Baterias Solares aprovadas de acordo com Standard IEC 61427
 - Cabos de Ligação dos módulos solares PV aprovados de acordo com Standards IEC 60227 ou IEC 60502
- **Equipamento Adicional PV:**
 - Kits Solares de Bombagem de Água
 - Unidades de Comando à Distância para Instalações Solares
 - Contadores de energia para Aplicações Solares de sistema Pay-As-You-Go¹⁹
- **Fogões:**
 - Importação livre de impostos para fogões e para peças para montagem classificados como Tier 2 ou superior em eficiência, no Clean Cooking Catalog²⁰ da Global Alliance for Clean Cookstoves (GACC)

¹⁹ Pagamento em prestações

²⁰ Clean Cooking Catalogue, Global Alliance for Clean Cookstoves. Available at: <http://catalog.cleancookstoves.org/stoves>

Annex B: Workshop attendance lists

Attendees at first workshop (12th July, 2016)

First Name	Surname	Organization	Position	Sector
Anibal	Mbalango	Autoridade Tributaria		Government
Katia	Murgy	Autoridade Tributaria		Government
Iolanda	Guilaze	Autoridade Tributaria		Government
Sheila	Ma??	FUNAE		Government
Americo	Alvaro	FUNAE		Government
Herminio	Massingu	FUNAE		Government
Jose	Ganhane	FUNAE		Government
Luis	Matsinhe	MEF / DNT	Chefe Departamento	Government
Damiao	Namuera	MIREME	Head of Renewable Energy Department	Government
Helia	??	MIREME		Government
Iazalde	Jose	MIREME		Government
Noa	Inacio	MIREME	Head of Dept of International Cooperation	Government
Rosario	Fischer	Energising Development (EnDev), GIZ	EnDev, Solar Component	Donor/Implementing Partner
Veronique	Stolz	Energising Development (EnDev), GIZ	Directora do Programa EnDev-Moçambique	Donor/Implementing Partner
Phil	Outram	DFID	Energy Lead	Donor/Implementing Partner
Peter	Robinson	Economic Consulting Associates Ltd	Director for the Africa Region	Consultant
Emmett	Costel			Researcher/Entrepreneur
Mayra	Pereira	GreenLight Ida	Researcher	Researcher/Entrepreneur
Gilda	Monjane	Loja de Energias	Founder	Private Sector
David	Small	Envirofit East Africa	MD East Africa	Private Sector
Federico	Dotto	Moçitaly Lta	Administrador e Director Técnico	Private Sector
Salva	Zita	Total Mozambique	Coordenadora de Projectos Comerciais	Private Sector
Casper	Sikkema	SolarWorks!	Managing Director Sub-Saharan Africa	Private Sector
Jose	Tavares	SolarWorks!	Moz Country Manager	Private Sector
Alessandro	Galimberti	AVSI	Director	NGO
Norato	Xerinda	FV-VEM		Other

Attendees at second workshop (18th August, 2016)

First Name	Surname	Organization	Position	Sector
Anibal	Mbalango	Autoridade Tributaria		Government
Joana	Tamele	Autoridade Tributaria	Técnica	Government
Felipe	Mondlane	FUNAE	Board Adviser	Government
Jornal	Rodrigues	FUNAE	Head of Solar and Wind Division	Government
Luis	Matsinhe	MEF / DNT	Chefe Departamento	Government
Luis	Mungamba	MEF / DNT	Técnico	Government
Marcelina	Mataveia	MIREME - DNE	Deputy Director	Government
Inocencio	Gujamo	MIREME	Técnico	Government
Gerson	Capote	MIREME - DNE	Técnico	Government
Iazalde	Jose	MIREME - DNE	Chefe de Departamento	Government
Zaina	Momade	MIREME - DNE	Técnica	Government
Rosario	Fischer	Energising Development (EnDev), GIZ	EnDev, Solar Component	Donor/Implementing Partner
Veronique	Stolz	Energising Development (EnDev), GIZ	Directora do Programa EnDev-Moçambique	Donor/Implementing Partner
Michael	Becker	GIZ		Donor/Implementing Partner
Joroen	van der Linden	SNV		Donor/Implementing Partner
Phil	Outram	DFID	Energy Lead	Donor/Implementing Partner
Peter	Robinson	Economic Consulting Associates Ltd	Director for the Africa Region	Consultant
Emmett	Costel			Researcher/Entrepreneur
David	Small	Envirofit East Africa	MD East Africa	Private Sector
Federico	Dotto	Moçtaly Lta	Administrador e Director Técnico	Private Sector
Vivian	Vendeirinho	RVE.SOL - Solucoes de Energia Rural Lda. / Rural Energy & Water Solutions	Founder & Managing Director	Private Sector
Casper	Sikkema	SolarWorks!	Managing Director Sub-Saharan Africa	Private Sector
Rosemin	Faquir	Tax lawyer		Private Sector
Camal	Raju	CTA		Other
Munir	Sacoor	CTA		Other
Orzendio	Zimba	CTA	Advisor of Consultative Mechanisms	Other
Valeriano	Pedro	CTA		Other
Laura	Morisio	AVSI	Operations Manager	NGO