

Energy Africa – Malawi

Technical assistance to model and analyse the economic effects of VAT and tariffs on picoPV products, Solar Home Systems and improved cookstoves

August 2017

This report and compact has been written by Economic Consulting Associates and produced by Evidence on Demand with the assistance of the UK Department for International Development (DFID) contracted through the Climate, Environment, Infrastructure and Livelihoods Professional Evidence and Applied Knowledge Services (CEIL PEAKS) programme, jointly managed by HTSPE Limited and IMC Worldwide Limited, now part of DAI.

The views expressed in the report are entirely those of the author and do not necessarily represent DFID's own views or policies, or those of Evidence on Demand. Comments and discussion on items related to content and opinion should be addressed to the author, via enquiries@evidenceondemand.org.

Contents

1. The importance of supporting the household energy sector	2
The important role of solar off-grid products in achieving universal access to electricity	2
The importance of efficient cookstoves	3
2. Development partner support to improving clean household energy access	5
Off-grid electricity sector	5
Improved cookstoves	6
3. Requested tax exemptions	8
4. Approach to the analysis	10
Micro-level	10
Macro-level	11
Description of the model	12
5. Analysis of model results	18
Product uptake	18
Fiscal impact vs socio-economic benefits	20
6. Recommendations	23
ANNEX 1: Consultations held to develop this study	24

1. The importance of supporting the household energy sector

The important role of solar off-grid products in achieving universal access to electricity

Approximately 88% of Malawi's 17.75 million people do not have access to the power grid, while in rural areas only 1% of the population enjoys the benefits of grid electrification.

Off-grid households rely on technologies such as kerosene lamps and battery powered torches to meet their lighting needs. These alternatives may provide lower-quality light and some are unsafe, damaging to health and more expensive compared to household solar products.

Acknowledging the important role that access to clean forms of electricity can play in the development of the country, the Government of Malawi (GoM) has joined the Sustainable Energy for All (SE4ALL) initiative and committed to a target of achieving universal access to electricity by 2030.

An Action Agenda (AA)¹ that presents a strategy for achieving the SE4ALL target was developed by GoM, with support from donor agencies in 2017. According to the AA, by 2030, 30% of all households will have access to the electricity grid. Assuming that the number of households will be approximately 5 million by then, around 3.5 million households would need access to off-grid electricity products for GoM to reach its electrification target.

In an effort to accelerate the expansion of the household solar market in Africa, the Energy Africa programme, a DFID-led, initiative was launched in 2015. This initiative focuses on removing policy and regulatory barriers to market expansion and aims at improving the co-operation of donors to provide more effective support to the sector.

A Malawi Energy Africa Compact was signed between the UK and the GoM in November 2016. The Compact represents the policy actions that are necessary to mobilise investment in the household solar market, while also mapping out the commitments of the Government and other development partners to support this process.

One of the priority policy actions identified in the Compact was the removal of VAT and import duties on clean energy technologies, which was seen as a major barrier to the acceleration of investment in the market. Even though solar lighting products are not subject to import duties in Malawi, they are still charged VAT at a rate of 16.5%. Taxation on these products contributes to high retail prices, making these products unaffordable to consumers, while also posing a risk to the financial viability of the solar businesses.

This study has been commissioned by DFID to examine the socio-economic impact of removing VAT and import duties on off-grid solar products, as well as improved cookstoves, the importance of which is discussed in the following section.

¹ Government of Malawi, 2017, SE4ALL Action Agenda

The importance of efficient cookstoves

Currently, approximately 95% of the population use wood and charcoal for cooking. Unlike in several neighbouring countries, firewood is extensively used in urban areas, providing almost half of the urban cooking fuel, while also being the only cooking fuel used in rural areas.

Due to the inefficiency of the fuel, GoM has banned the production and sale of charcoal. However, illegal trading of charcoal, often facilitated by the rural population, is booming in response to the high demand in Malawi's cities.

The majority of households (more than 80%), both in urban and rural areas, use open three-stone fires for cooking. These stoves are highly inefficient and consume about 90 kg of firewood per household per week²³, or approximately 50 kg of charcoal a month. The annual consumption of 7.5 million tonnes of wood that is required to support the current cooking activities, by far exceeds the sustainable supply. As a result, significant pressure is exerted on forest resources, leading to significant forest degradation and deforestation⁴. Extensive deforestation also makes communities more prone to flooding and drought.

The high consumption of fuelwood and charcoal for cooking increases the incidence of indoor air pollution related diseases and is also largely responsible for the fact that the forestry sector is the biggest contributor to carbon dioxide emissions in Malawi (78%)⁵. The collection of fuel for cooking also has negative implications on the lives of the citizens, primarily women and children, who spend considerable time every week collecting firewood and charcoal. The high rate of deforestation also means that they often need to travel longer distance to collect wood fuel.

In response to this problem, GoM, through the Department of Energy, developed a Biomass Energy Strategy (BEST) in 2009. The objective of this strategy was to develop a realistic and financially feasible approach to improve the sustainability of the biomass energy supply, through the promotion of more energy efficient cooking appliances, both for commercial and household use. The following recommendations were made as part of the BEST⁶:

- ❑ Incentives should be provided to those businesses that are involved in the biomass sector

² RippleAfrica, 2017. General Information About the Environment in Malawi and Deforestation in Africa, available from: <http://www.rippleafrica.org/environment-projects-in-malawi-africa/deforestation-in-africa>

³ The Guardian, 2017. 'Illegal logging in Malawi: can clean cooking stoves save its forests?'. Available from: <https://www.theguardian.com/sustainable-business/2017/feb/23/illegal-logging-in-malawi-can-clean-cooking-stoves-save-its-forests>

⁴ Energizing Development, Malawi: Energy Situation, available from: <http://endev.info/content/Malawi>

⁵ Government of Malawi, 2017, SE4ALL Action Agenda

⁶ Government of Malawi, 2009, Malawi Biomass Energy Strategy, available from: http://www.euei-pdf.org/sites/default/files/field_publication_file/EUEI_PDF_BEST_Malawi_Final_report_Jan_2009_EN.pdf

- ❑ The regulatory environment in the biomass sector should be conducive to private sector operations
- ❑ Institutions should be established to ensure that the biomass sector operates in the formal sector

Acknowledging the potential of improved cookstoves to reduce the adverse health and environmental impacts related to current cooking practices, GoM has developed a Cook Stoves Road Map, which targets the increase in clean and energy efficient stoves from 500,000 in 2016 to 2 million households by 2020. Following the launch of this initiative, a National Cookstove Taskforce, chaired by the Ministry of Energy and supported by various development partners, was formed to coordinate the efforts towards achieving the Government's commitment of increasing the uptake of improved cookstoves.

The main policy goals outlined in the Cook Stoves Road Map include⁷:

- ❑ Testing mechanisms should be put in place to assess the standards of cook stoves
- ❑ The promotion of cookstove technologies should be based on evidence of energy efficiency savings
- ❑ The capacity of local producers in relation to improved cookstoves should be strengthened
- ❑ Financing mechanisms should be devised for the encouragement of more efficient cookstoves.

The Road Map emphasises that in order to achieve the set target, different types of improved cookstoves need to be promoted, according to the needs of the market. Taxation on energy efficient stoves is also seen as a major impediment to the development of the market and subsequently to the achievement of the GoM's target.

The use of improved cookstoves as a means of fostering sustainable energy development is also supported by the Malawi Climate Policy and in the country's Intended Nationally Determined Contribution (INDC).

Household solar products and improved cookstoves can play an important role in meeting universal energy access target as set out in the SE4ALL initiative and in the draft Malawi Renewable Energy Strategy (MRES).

⁷ Cook Stove Road Map, 2015

2. Development partner support to improving clean household energy access

Off-grid electricity sector

As noted above, the wider Energy Africa campaign aims at accelerating the expansion of the household solar market in Africa, and as part of this campaign a Compact was signed between the GoM and DFID in November 2016.

The main objectives of this Compact were to:

- ❑ Remove policy and regulatory barriers to mobilise large volumes of private finance that is required for the rapid expansion of the off-grid solar market
- ❑ Create an investment environment for clean energy products that is more attractive to businesses
- ❑ Remove any fiscal barriers that pose an obstacle to the development of the market
- ❑ Foster better co-ordination of donor efforts

One of the key policy actions proposed under the Compact was the removal of VAT and other import duties on clean energy household products.

In support of the implementation of the Compact, this study aims at estimating the financial and socio-economic impact of removing the VAT and import duties from eligible clean energy products.

Malawi is also one of the beneficiaries of the AECF Renewable Energy and Adaptation to Climate Technologies (REACT) Challenge Fund that was established in 2010 with the purpose of accelerating access to affordable electricity in rural and peri-urban areas through household solar products. As part of this programme, DFID provides financial support to innovative household solar businesses in Malawi aiming at catalysing private sector investment in the market for low cost and clean household energy products.

Following the Energy Africa Campaign and other successful initiatives to expand the off-grid solar energy market, the UK government has approved a £43 million programme known as Africa Clean Energy Business (ACE) to help in catalysing a market-based approach for the expansion of the off-grid renewable energy market in 14 African countries, including Malawi. The support provided as part of this programme will be in the form of:

- ❑ Technical assistance to build a more conducive business environment for the distribution of solar home systems (SHS) and related services
- ❑ Financial assistance to businesses that want to enter new and emerging SHS markets

- ❑ Testing and promoting innovative ideas and technological solutions that would accelerate the expansion of the market

Other development partners are also providing support to the development of the off-grid solar market. For instance, GIZ, is currently developing a national awareness campaign to promote the dissemination of high quality household solar products, targeting to reach 125,000 rural households⁸.

Improved cookstoves

In 2012, Malawi became one of the beneficiaries of the global Energising Development (EnDev) programme, which aims at promoting access to clean energy technologies. In Malawi, the programme on Biomass Conservation (ProBEC) focuses on developing a financially sustainable market for improved cookstoves, by strengthening the supply and the demand for these programmes⁹.

Demand-side activities relate to raising the awareness of consumers regarding the availability and benefits of using a ceramic, wood-burning stove, known as the 'Chitetezo Mbaula', which reduces the fuel requirement by 40% compared to the traditional three-stone fire.

On the supply side, EnDev Malawi builds the capacity and skills of local businesses who want to produce the improved cookstoves. The organisation works together with a local NGO called MAEVE, to help small-scale producers of improved cookstoves to market their products by linking them with large sales outlets¹⁰.

By 2014, more than 90,000 people had gained access to improved cookstoves, as a result of the EnDev programme, commissioned by GIZ¹¹. Due to the expansion of the stove-making market, 400 additional jobs were created, with 75% of the new employment positions occupied by women¹². The project, once completed, is expected to result in savings of 65,000 tonnes of wood, or 50,000 tonnes of carbon emissions per year¹³.

Another large programme aimed at promoting the use of improved biomass stoves that generate fewer emissions was the EU-funded programme called Msamala Sustainable Energy Project (MSEP). As part of this project, between 2007 and 2010, Concern Universal, who was managing the project, distributed 9,000 energy efficient stoves to residents in Balaka district¹⁴.

Total Land Care, an NGO based in Malawi, has also been active in the development and marketing of clean and efficient cookstoves, through its commercial arm, Total Land Care Green (TLCG). A US based social enterprise called Envirofit has also been involved in the design and promotion of

⁸ GIZ, Energising Development (EnDev) Malawi, available from: <https://www.giz.de/en/worldwide/28795.html>

⁹ GIZ, Energising Development (EnDev) Malawi

¹⁰ Endev Malawi, available from: <https://endev.info/content/Malawi>

¹¹ Endev Malawi

¹² Endev Malawi

¹³ GIZ, Energising Development (EnDev) Malawi, available from: <https://www.giz.de/en/worldwide/28795.html>

¹⁴ Orr et al, 2013. Testing Integrated Food Energy Systems: Improved Stoves and Pigeon Pea in Southern Malawi, available from: <https://europa.eu/capacity4dev/msamala-sustainable-energy-project/document/testing-integrated-food-energy-systems-improved-stoves-and-pigeon-pea-southern-malawi>

energy-efficient cook stoves in Malawi. The organisation claims that the stoves it produces consume between 57% and 74% less fuel than traditional stoves¹⁵.

Several development partners involved in the promoting of improved cookstoves in Malawi were consulted as part of this study, the names of which are presented in Annex 1.

¹⁵ Giel de Pooter, 2014. Clean cooking, progress report, available from:
http://stichtingstgabriel.nl/pdfs/Clean_Cooking_Progress_Report_November_2014.pdf

3. Requested tax exemptions

Malawi, according to World Bank statistics¹⁶, is one of the poorest countries in the world. Several socioeconomic and political factors have prevented the development of the economy, one of them being the lack of access to modern energy services. The latter underpins education and poses a constraint to the growth of businesses.

The households that are not served by the national grid, accounting for approximately 88% of the total, rely on alternative, and more expensive, fuels, including kerosene, wood and charcoal to meet their energy needs. As a result, they pay a disproportionately higher share of their income for energy than those who enjoy access to the power grid.

Therefore, access to affordable and environmentally friendly energy sources would significantly improve people's quality of life and should eventually allow the economy to grow faster. In recognition of this, the GoM has removed import duties from solar products. However, VAT remains payable on all solar products at 16.5%. Cookstoves, irrespective of their quality, are subject to both import duties and VAT charged at 16.5%.

In order to achieve accelerated investment and uptake of household solar systems and improved cookstoves the proposal being put forward requires that **for the next 10 years (2018-2027) quality clean energy products should be subject to:**

- ❑ **0% import duties** - current values vary from 0% import duties on off-grid solar products up to 25% for cookstoves
- ❑ **Zero rated VAT** – all energy products are currently subject to a 16.5%VAT.

Even though solar products are currently exempt from import duties, solar companies have to pay import VAT when they import products, before they can clear custom. Once the products are sold and VAT charged to consumers, the VAT paid on imports is deducted from the amount of VAT owed to the the revenue authority in order to avoid double payment of VAT. However, the VAT charges on imports has a negative impact on the companies' cashflows and there are uncertainties around the recovery of the VAT charges from the revenue authority; several companies mitigate this risk by increasing the price of their final product.

Moreover, according to most private companies interviewed, solar companies importing SHS with DC appliances such as TV and fans have noted that although solar systems are exempt from import duties, DC appliances running on solar energy are not. This duty increases the price of the home systems significantly.

According to all private solar companies interviewed, taxation is a major impediment to the development of the market. Given that the majority of household solar products sold to the market are imported, those involved in the distribution of such products face significant currency exchange risks, which pose a challenge to the sustainability of these businesses. VAT exemption would help those companies to mitigate this risk. Also, evidence from other Sub-Saharan African countries (i.e

¹⁶ <http://databank.worldbank.org/data/download/GDP.pdf>

Kenya) suggests that removing taxation on renewable energy household products can have a significant impact on accelerating the deployment of off-grid solar products¹⁷.

For cookstoves, the import duty (25%) is added on top of the total cost of the imported product¹⁸. VAT (16.5%) is then calculated on the total landing cost of the products, including the import duty.

In Malawi, there are currently around 225 local groups, engaging approximately 4,000 people in the production of stoves. However, only 5 of them are semi-industrialised. VAT on these products puts a significant pressure on the sustainability of the businesses involved in the cookstove production and also provides an incentive to such businesses to operate in the unofficial market. Import duties on cookstoves are less important given that only a tiny fraction of the cookstoves sold in the market are imported from abroad. VAT exemption on eligible improves stoves could improve the sustainability of the local production groups, as well as benefit consumers by making energy-efficient stoves more affordable.

The relative success of the incentive scheme should be reviewed by the end of 2027 to assess whether its objectives have been met and decide whether the market has become sustainable in which case no tax incentives will be required.

¹⁷ Solar Aid, 2014. Kenya celebrates VAT exemption for solar, available from: <https://solar-aid.org/kenya-celebrates-vat-exemption-solar/>

¹⁸ Includes the factory prices plus transport costs

4. Approach to the analysis

Micro-level

According to the Business Innovation Facility (BIF), almost two thirds of off-grid households are currently using torches with batteries for lighting, while the remaining households rely mostly on kerosene and candles.

A recent study by BIF shed light on the lighting and phone charging habits of off-grid households in Malawi¹⁹. According to the findings from this study:

- ❑ Malawians spend approximately \$50 million every year on poor quality and harmful lighting
- ❑ The payback period of pico-PV products is 8 months when compared with torches and 15 months when compared with kerosene lamps
- ❑ The expected lifetime of a household solar product is 5 years, while most good quality products come with a 2-year warranty
- ❑ Solar lighting records the highest level of satisfaction (71% for pico-PV products and 55% for solar home systems)
- ❑ 78% of current non-renewable lighting users are interested in acquiring solar lighting

While the findings from this study show that by switching to solar products households can achieve significant financial savings (net of upfront costs), the current uptake of solar lighting is only around 13%, which translates to approximately 2 million people.

The same study found that in each off-grid household there are, on average, 1.62 mobile phones. These phones are usually charged by small-business owners in return for a fee that ranges from between \$0.15-0.25 per charge. In kWh terms, this equates to approximately \$30-50 per kWh for electricity services²⁰. Most household solar kits now provide mobile-phone charging and therefore further financial savings are realised from money that would otherwise be spent on phone-charging. Additional savings are incurred due to the fact that phone owners no longer need to travel to reach a charging kiosk.

A recent study in Uganda found that after accounting for weekly payments towards the cost of paying for the SHS, customers find that their weekly expenditures drop by \$1.41, thus spending 73% less than households that rely on traditional fuels for lighting²¹. Also, according to the Lighting Global programme, off-grid households achieve savings that range between \$20 and \$40 a year by switching to household solar products²².

¹⁹ BIF 2016. Off-grid lighting and mobile charging study: A snapshot of household technologies, habits and expenditure in Malawi

²⁰ Lighting Global, 2016. Off-Grid Solar Market Trends Report.

²¹ d.Light, Idinsight, USAID, Shell Foundation, UK aid, 2015. d.Light Solar Home System Impact Evaluation

²² Lighting Global, 2016, Off-Grid Solar Market Trends Report.

With regards to cooking, the majority of households currently rely on inefficient cookstoves that require 40-50% more wood fuel to operate than their improved counterparts²³. By switching to cleaner and more energy-efficient cookstoves, households can significantly reduce the amount of firewood and charcoal they consume.

A reduction in expenditures as a result of using more cost-effective energy products means that households will have a higher disposable income that can be used on other household priorities.

Apart from the direct financial savings which relate to reduced expenditure on meeting their lighting and cooking needs there are several other benefits accrued by households from the use of clean energy projects. Such benefits include:

- ❑ **Education** – Solar products can provide over 2 hours of additional lighting per day, allowing for additional studying hours, thus improving children’s learning outcomes^{24 25}. Users of solar products that come with appliances also get access to new information sources through radio and TV.
- ❑ **Health improvements** – The majority of burn victims in Malawi relate to liquid scalds and open fire burns. Pico-PV solar products prevent the accidents that could have occurred with the use of paraffin, while improved cookstoves are much safer than traditional three stove open fire ones because the stoves are designed in a way that shields the fire to contain heat and therefore protects against burns²⁶. Also, cleaner stoves reduce the incidence of respiratory problems, and/or eye problems caused by indoor and ambient air pollution linked to low-quality cookstoves and kerosene lamps. According to a recent study²⁷, 0.00023 deaths and 0.0156 disability adjusted life years (DALYs) are avoided per household that uses improved cookstoves every year as a result of reduced indoor pollution.
- ❑ **Productivity** – A lot of time is currently spent on collecting fuel; by switching to cleaner and more reliable energy products, households can save time which they can redirect to productive and educational purposes.

Macro-level

The use of off-grid solar products and improved cookstoves not only lead to significant financial savings and health improvements at the household level, but they also have a beneficial impact on the overall economy. Expected benefits at the national level include:

- ❑ **Employment** – The promotion of household clean energy products is likely to increase the demand for these products, therefore creating micro business opportunities. This could have a multiplier effect on the economy, since the income earned by the new businesses will be spent on other goods and services. A recent

²³ Government of Malawi, 2016, SE4ALL Action Agenda

²⁴ Enea Consulting, 2012. Social Impact Assessment of BBOX in Uganda.

²⁵ Samad, H.A., 2013. The benefits of solar home systems: an analysis of Bangladesh. World Bank Policy Research Working Paper 6724.

²⁶ Gold Standard, Malawi Biomass Energy Conservation Project, available from: <https://www.goldstandard.org/projects/malawi-biomass-energy-conservation-project>

²⁷ Anenberg et al, 2017. Air pollution-related health and climate benefits of clean cookstove programs in Mozambique, available from: <http://iopscience.iop.org/article/10.1088/1748-9326/aa5557>

UNEP study²⁸ has estimated that for every 10,000 off-grid households gaining access to solar products, 30 more jobs are created compared to fuel-based energy value chains. Also, according to the Malawi Biomass Energy Conservation project, for every 1,000 households switching to improved cookstoves, 25 additional jobs are created.

- ❑ **Environment** – Off-grid solar products will displace the consumption of kerosene and batteries, while improved cookstoves will significantly reduce household solid fuel combustion. This will result in lower carbon emissions, slower deforestation and less environmental damage caused by the decomposition of dry cell batteries²⁹.
- ❑ **Economic growth** – The diffusion of off-grid solar products to small businesses can lead to extended opening hours, which translate into higher levels of economic growth. Also, reduced health problems resulting from a cleaner and safer environment in kitchens will have a positive impact on the economic productivity.
- ❑ **New sources of tax revenue** – Extended businesses hours will result in increased business tax revenues, while higher employment and economic growth resulting from the promotion of clean energy technologies will lead to greater VAT revenues.

This study aims at quantifying the socio-economic benefits discussed above and compare them with the foregone fiscal revenues resulting from the VAT and import duty exemptions on eligible clean energy products.

A description of the model that was developed for the purpose of this exercise is provided below. Despite its sophistication, it was not rendered possible to quantify all the benefits outlined above and as such the results of the model can be considered conservative estimates of the potential impact.

Description of the model

Introduction

In this section we outline the model used for the purposes of this assignment. This model is an adaptation of the existing Energy Africa general model for assessing the macro-economic implications of taxes on clean energy household technologies. For that reason, the description of model is similar to that presented in the report that introduced the general model³⁰.

The model simulates the fiscal and household expenditures, as well as other economic costs and benefits associated with the off-grid energy supply from 2018 until 2038.

²⁸ UNEP 2014. Light and Livelihood: A Bright Outlook for Employment in the Transition from Fuel-Based Lighting to Electrical Alternatives, available from: <http://www.enlighten-initiative.org/portals/0/documents/Resources/publications/Light%20and%20Livelihood%20-%20A%20Bright%20Outlook%20for%20Employment.pdf>

²⁹ Anenberg et al, 2017. Air pollution-related health and climate benefits of clean cookstove programs in Mozambique, available from: <http://iopscience.iop.org/article/10.1088/1748-9326/aa5557>

³⁰ Economic Consulting Associates, 2016, Technical Assistance to model and analyse the economic effects of VAT and tariffs on picoPV products, Solar Home Systems and Improved Cookstoves. Evidence on Demand

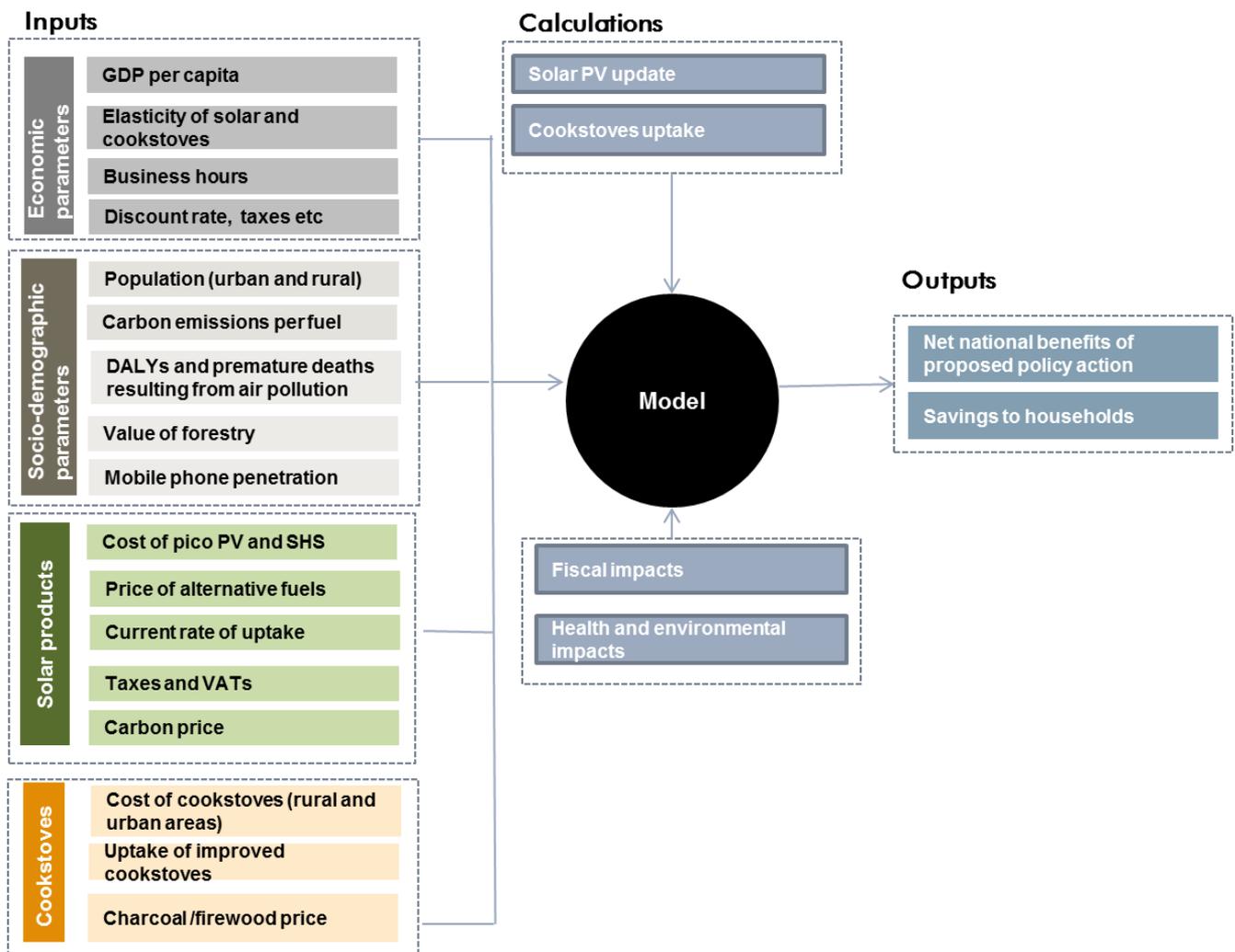
The main purpose of the model is to measure the potential impact of removing the VAT and import duties on eligible household solar products and improved cookstoves, both on households and on the economy in general.

The general structure of the socio-economic model is shown in the figure below. The flow of the model is from inputs, through calculations to outputs, including the uptake analysis, revenue calculations and the socio-economic analysis. The blue boxes constitute the core of the model, which estimated the growth in the uptake of household energy products with and without the tax exemptions, and measures the fiscal impact and other benefits, so that the cost-effectiveness of the proposed policy measure can be assessed.

The model comprises a single MS Excel file, known as a 'workbook', comprising multiple 'worksheets':

- ❑ **A Cover worksheet**
- ❑ **A Contents worksheet:** This sheet summarises all the worksheets in the model, provides a key on the colour coding used within the model, and a version history of the model's development.
- ❑ **INPUTS/data worksheet:** This sheet includes all the assumptions and parameters for the calculations. Inputs are easily identifiable by category: economic parameters, population parameters, energy parameters, environmental, health impacts, etc.
- ❑ **CALC/Uptake worksheet:** This worksheet develops the calculations of the uptake of household solar products and cookstoves under two scenarios; one assumes that taxes and import duties are removed from eligible household energy products and the other one assumes no policy action.
- ❑ **CALC/Fiscal Impact worksheet:** This worksheet uses the uptake estimates from the uptake calculations page and calculates the impact of the proposed policy action on the government's finances and on the households' expenditure.
- ❑ **CALC/Health and environmental impact:** This worksheet presents the calculation on the monetised impact on people's health and the environment
- ❑ **CALC/ Impact summary:** This worksheet presents a summary of all potential impacts.
- ❑ **OUTPUT/Charts worksheet:** This worksheet presents various summary charts from the model's data, ready for exporting into other media, e.g. reports, presentations.

Figure 1: Structure of the model



Product uptake

In order to measure the potential socio-economic impact, the model compares the expected uptake of clean energy products following the removal of taxes and other duties, with the uptake that would have been realised if there was no policy intervention (“baseline” growth rate).

This baseline growth rate in the uptake of household energy project relates to two main factors:

- ❑ **The population growth;** an increase in the size of the population will put an upward pressure in the demand for off-grid energy products
- ❑ **The reductions in costs (demand-side effect);** as household energy products become more affordable, due to declining production costs arising from technological advances, their demand increases.

The new policy scenario assumes that the reduction of VAT and import duties on eligible products will increase the penetration of clean household energy products during the first year of the policy implementation and will also lead to higher levels of uptake, compared to the baseline scenario, due to the increase in population in subsequent years.

The magnitude of the increase in the demand for these products resulting from the tax removal will depend on how responsive demand is to changes in prices (i.e elasticity of demand). Based on the results from other studies³¹, an elasticity of demand of -0.567 for household solar products was assumed in the model.

A study conducted by Yale and Stanford Universities³² found that a reduction in the price of improved cookstoves in Bangladesh by 50% is associated with an elasticity of demand of around -2.

However, the degree to which suppliers of eligible household energy products will pass on the reduction in production costs to consumers is uncertain. An important addition to the current version of model, developed for this assignment, is that it allows the user to choose what percentage of the decrease in prices, resulting from the removal of taxes, is passed on to consumers. The results presented here assume that final retail prices of clean energy products will be reduced by an amount equal to 90% of the price decreases resulting from VAT and import duty exemptions.

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

The counterfactual

One of the primary goals of this model is to estimate the fiscal impact of removing VAT and import duties on eligible household energy technologies.

In order to estimate the net fiscal impact of this policy action, the foregone revenue resulting from VAT/import duty exemptions is compared with the baseline scenario. The reason why only baseline uptake is counted towards the estimation of the foregone revenues is because the sales revenues from any additional uptake resulting from the policy action would not otherwise exist.

Similarly, the estimation of benefits arising from the VAT/duties exemption relate to those associated with the additional uptake in clean energy technologies. This is because the benefits from the baseline uptake of household solar products and improved cookstoves would occur irrespective of the tax reductions.

Alternative sources of revenue resulting from higher uptake of clean household energy products

Additional revenues streams will be created through:

- ❑ **Employment creation:** According to a recent UNEP study³³, the off-grid solar market creates approximately 30 more value-chain jobs than the number of jobs lost by kerosene sellers. The model then assumes that each of the additional jobs created earns the average income in Malawi. Assuming that these people have no savings and will be spending their entire salary on the consumption of goods and services, the additional VAT revenue to the government will be proportional to their earnings.

³¹ Bloomberg, 2016. Off-Grid Solar Trends Report

³² Mobarak et al, 2012. Low demand for nontraditional cookstove technologies, available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3390883/pdf/pnas.201115571.pdf>

³³ UNEP 2014

- ❑ **Business taxes:** A percentage of households are assumed to be using solar home systems for business purposes³⁴. These systems allow businesses to extend their operating hours from 10 to 12 hours, which has a positive impact on sales revenues. The model assumes that the applicable business tax rate will be payable on the additional revenues made as a result of this policy action.

The model also assumes that the share of clean household energy products produced domestically increases steadily. Therefore, the foregone duty revenues decrease over time as more suppliers establish production operations in Malawi.

Impact on household savings

Household savings arise from fuel expenditures that would otherwise take place if households continued using kerosene lamps and battery powered flashlights, and from additional charcoal and firewood that would be consumed as a result of using inefficient cookstoves. These savings are then compared with the upfront costs of pico-PV lights, solar home systems and improved cookstoves.

According to a recent BIF survey³⁵, 61% of households in Malawi own a mobile phone. These households, if they acquire a household solar product (assuming it has a charging socket) they will no longer need to pay vendors to charge their mobile phones.

Estimating the indirect benefits arising from VAT/duty exemptions

Apart from the fiscal impact of VAT/duty exemptions on eligible clean energy products, the model also measures the indirect benefits to health and the environment resulting from a reduction in the usage of inefficient cookstoves. The benefits include:

- ❑ **Decline in premature deaths and DALYs (Disability-Adjusted Life Years):** Cooking with biomass fuels has negative implications on people's health. By switching to more efficient cookstoves, the rate of premature deaths and DALYs (after adjusting for the crude death rate) falls. This avoided loss of income of those who would otherwise have prematurely died or lived with a disability is counted as a benefit of the proposed policy intervention. However, it should be noted that this estimate is based on a projected income growth rate for the working population and makes no assumptions about the age distribution of those whose health has been affected. The model implicitly assumes that the impact on the young population (higher) nets out the impact on the old (lower) population and therefore the impact on the current working-age person becomes representative of the total societal impact.
- ❑ **Decline in CO₂ emissions, biomass conservation:** By reducing the usage of kerosene and batteries and by switching to improved cookstoves that require a smaller amount of firewood to operate results in significant CO₂ emissions reduction. Assuming a carbon

³⁴ The existing Energy Africa general model for assessing the macro-economic implications of taxation on clean energy household technologies assumes that 10% of all households that use any type of solar products will be involved in business activities. In this model, it is assumed that 20% of only those households that use *solar home systems* are involved into business activities.

³⁵ BIF 2016. Off-grid lighting and mobile charging study: A snapshot of household technologies, habits and expenditure in Malawi

price of 4.3 \$/tCO₂³⁶, the model measures the total value of reduced CO₂ emissions. Also, by assigning a per-hectare economic value of forest / biomass conservation, the model measures the value of preserved forestry as a result of this policy action. This reflects not only the intrinsic value of trees, but also the economic impact of deforestation on river catchments and its impact on agriculture.

Estimates for the parameters mentioned above are taken from recent health/environmental literature, either specific to Malawi or other regional countries.

³⁶ Walker et al 2012, Scoping of Opportunities and Institutional Assessment for Malawi's Engagement in the Carbon Markets: Opportunity Assessment and Institutional Capacity Report. Available from: <https://www.winrock.org/wp-content/uploads/2016/03/Malawi-Engagement-in-the-Carbon-Market.pdf>

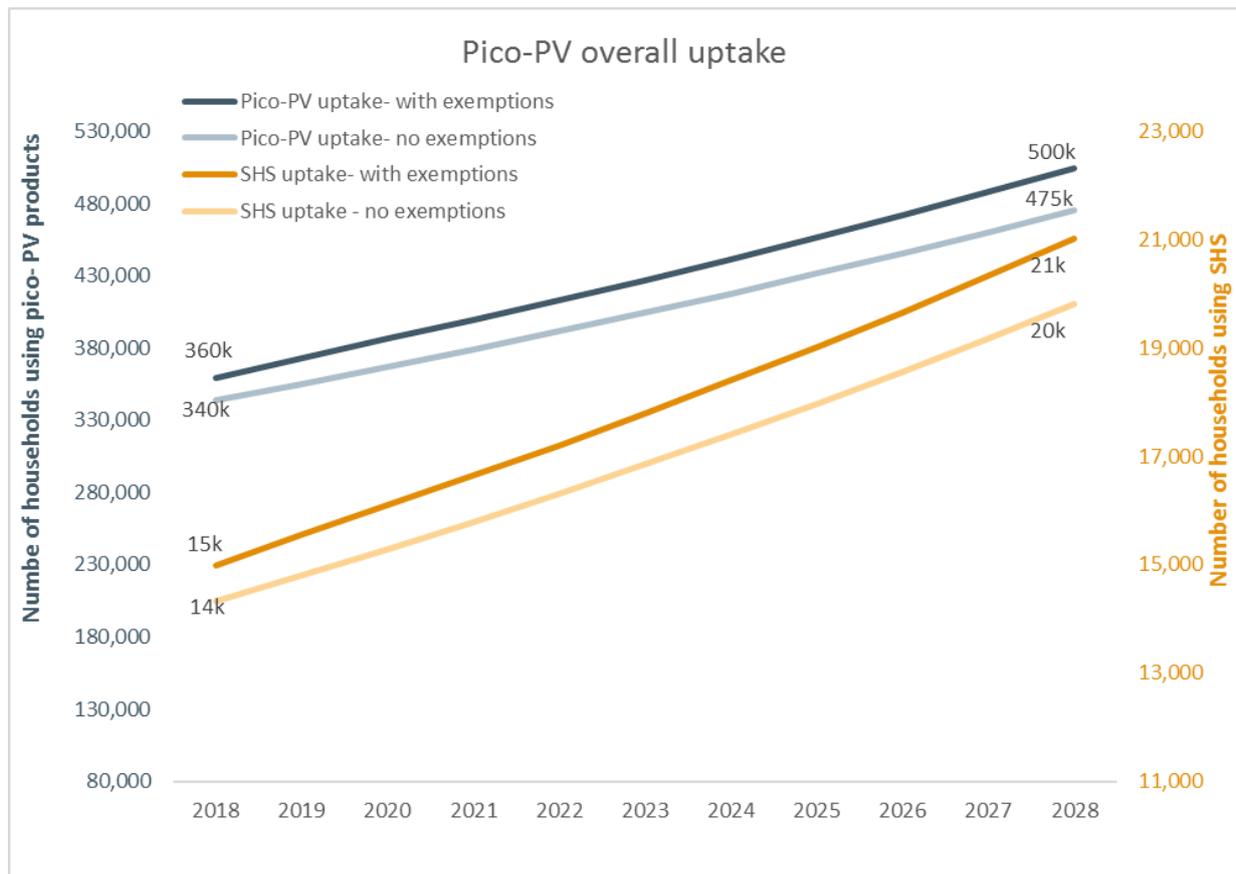
5. Analysis of model results

Product uptake

Currently, 11.3% of rural households and 3.8% of urban households are currently using solar lighting. Assuming a baseline growth rate in the uptake of pico PV products of 0.2% in rural areas and 0.05% in urban areas and a gradual reduction in production cost due to technological advances, by 2028 there will be approximately 475,000 households using pico-PV lights, or approximately 135,000 more than today.

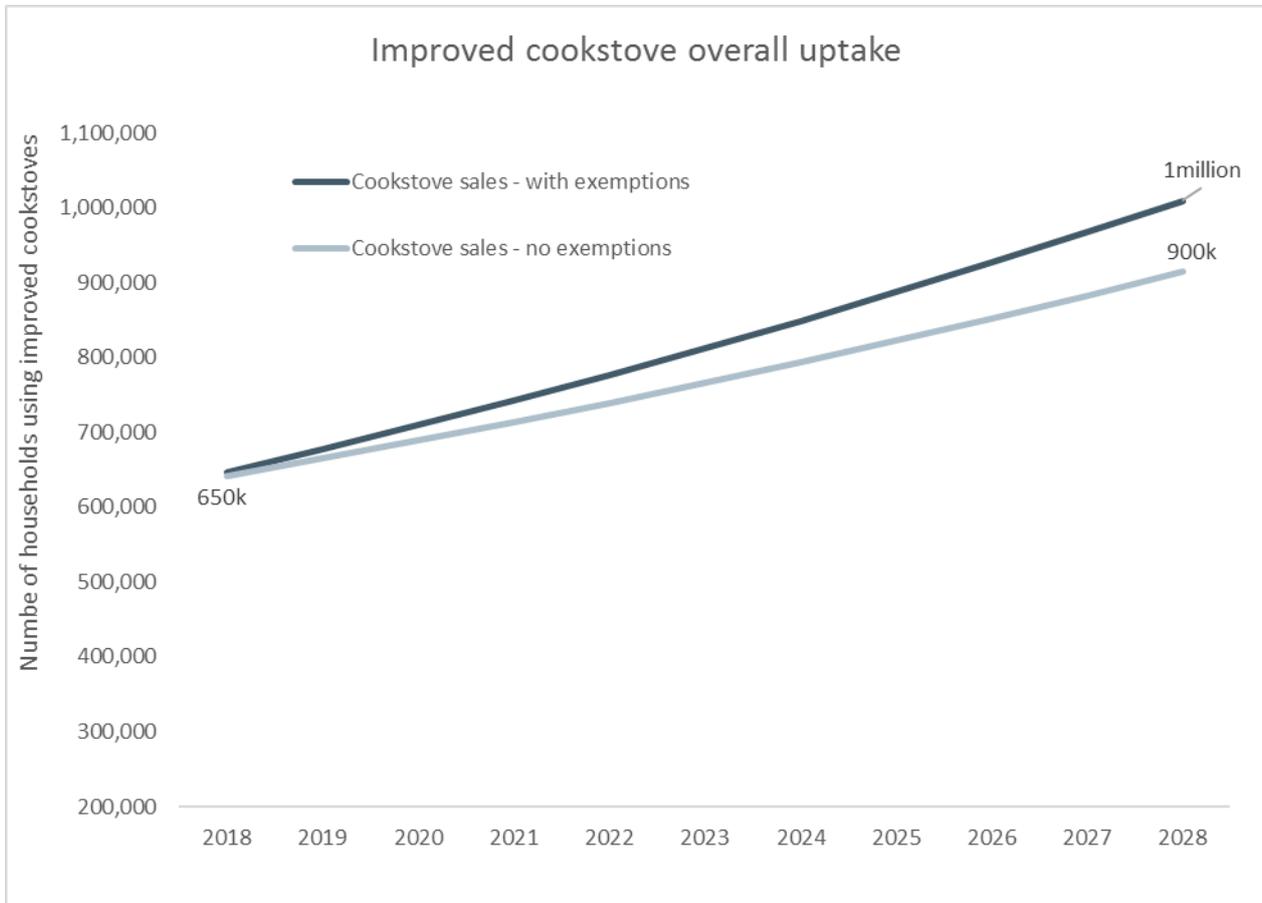
Applying a price elasticity of penetration of -0.567 the removal of taxes from these products will lead to a significant increase in the uptake compared to the baseline scenario. It is expected that if the new policy is implemented, more than half a million people will be using pico-PV lights by 2028, or 25,000 more compared to the baseline scenario.

The current uptake of solar home systems is much lower than that of pico-PV lights, according to BIF, with only 4% of those that use solar products having a SHS. Without the removal of VAT on these products, it is expected that approximately 20,000 households will be using these products by 2030. Assuming that a 1% decrease in prices causes a 0.88% increase in demand for SHS, this figure is projected to 21,000 if these products are exempt from VAT.



Given that currently 17.6% and 20% of rural and urban households respectively use improved cookstoves³⁷ and applying a baseline growth rate in the uptake of improved cookstoves of 0.5% per year, without any policy intervention it is expected that the number of households using these cookstoves in 2030 will increase to approximately 900,000.

On the other hand, if taxes and import duties are removed, it is expected that by 2028, approximately 1 million households will have access to improved cookstoves.



As shown in Table 3 below, over the ten-year period of requested tax exemptions, the annual average growth rate of pico-PV lighting products and SHS is 0.1 percentage points higher in the new policy scenario, compared to the baseline. For improved cookstoves, the difference in the average annual growth rate between the two scenarios is 1.4 percentage points.

If the new policy is implemented, approximately 25,000 more households will be using pico-PV products and 1,000 more households will have a solar home system, compared to the baseline scenario.

Similarly, 84,000 more households will gain access to improved cookstoves, compared to the baseline scenario.

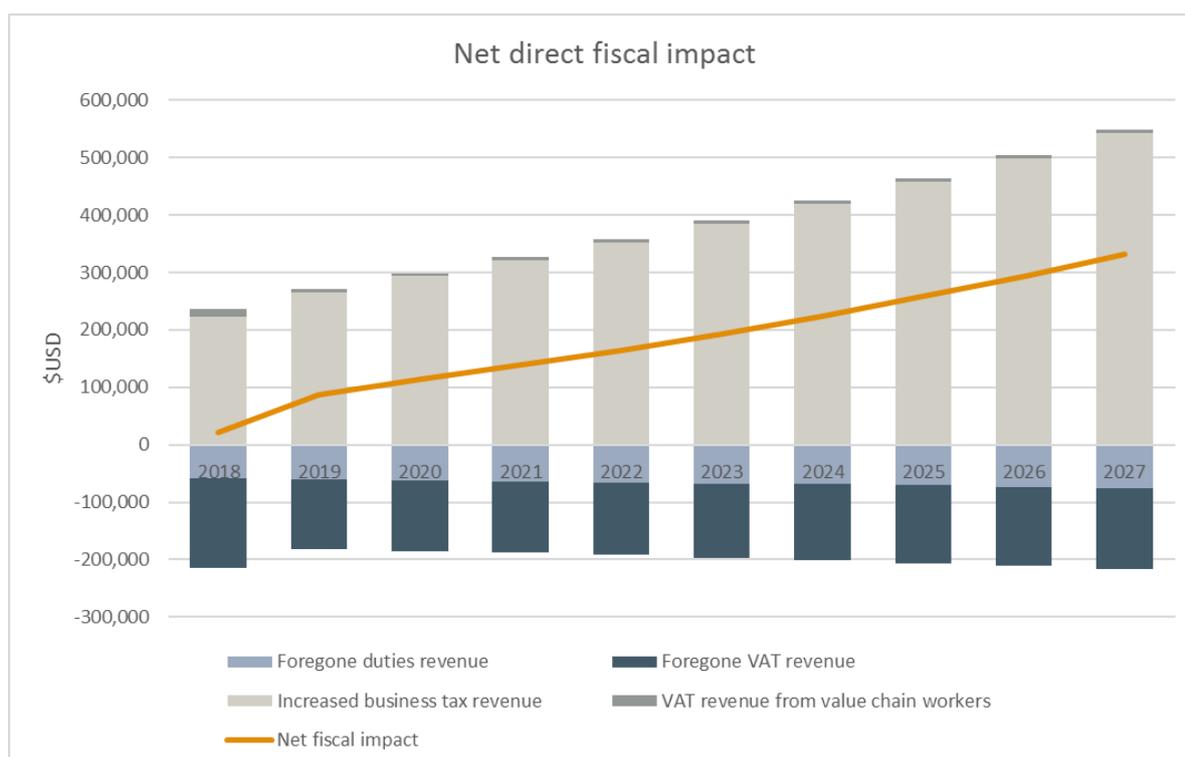
³⁷ SE4ALL Action Agenda

Table 1 Product uptake data 2018-2027

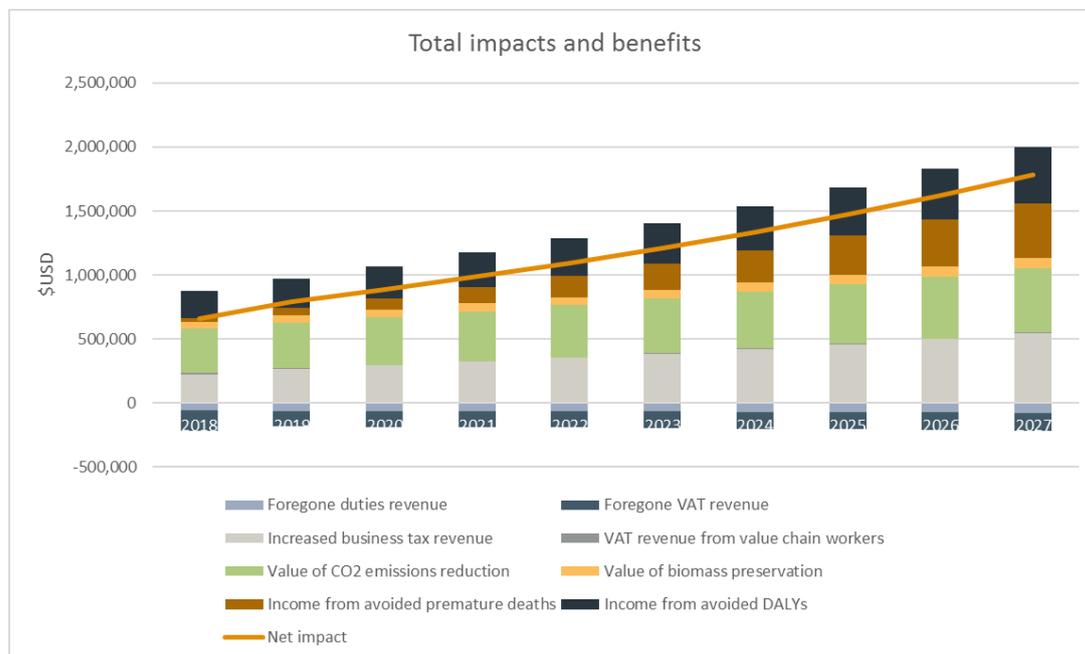
Impact (2018-2027)	Without new policy	With new policy
Growth rate pa pico-PV	3.3%	3.4%
Growth rate pa SHS	3.3%	3.4%
Growth rate pa improved cookstoves	3.2%	4.6%
Households purchasing pico PV 2018-2027	460,369	487,904
Households purchasing SHS 2018-2027	19,182	20,329
Households purchasing improved cookstoves 2018-2027	882,598	966,984

Fiscal impact vs socio-economic benefits

The proposed policy once implemented by the government, would result in zero rating VAT and the complete removal of import duties on eligible products. As a result of these measures, there will be a negative impact on the tax revenues received by the Malawi Revenue Authority (MRA). However, as shown in the graph below, additional business tax revenues, due to businesses operating longer hours and VAT paid through the consumption of new workers in the sector, will offset the foregone tax revenues from clean energy products. It is projected that from the first year of policy implementation the government will be in a positive fiscal position.



If health and environmental benefits are also taken into account, then the **net total national impact** is projected to be even more positive. More specifically, the net total impact will increase from \$660,000 in 2018 to \$2.2 million in 2028. There will be a sharp drop in the net national impact from 2029 onwards due to the removal of tax exemptions, but the overall impact will remain positive.



The above analysis does not include the financial benefits of this policy change accrued by households. As discussed in section 4, by switching to clean and more efficient energy products, households can achieve significant savings in terms of energy expenditures. In real terms, due to the higher uptake of clean energy products, household savings will increase from approximately \$2.2 million in 2020 to \$3.8 million in 2027.

Table 2 below provides a breakdown of the expected net overall national impact of implementing the proposed tax exemptions between 2018 and 2027. A discount rate of 8% has been used to estimate the current value of the net impact over the ten-year period. While the net fiscal impact due to foregone revenues is equal to \$1.19 million, the national benefits, including those accrued by households, amount to \$8.23 million and, therefore, the net national impact is estimated to \$9.41 million.

Table 2 Fiscal, health and environmental impact and household benefits (US\$ millions over 2018-2027)

Net Impact - US\$ millions (2018-2027), discounted	
Fiscal impact	
VAT lost revenues	-0.96
Import duty lost revenues	-0.47
VAT revenue from spending on additional value chain workers	0.05
Business income tax revenue from additional operating hours	2.57

Health impact	
Income from avoided premature deaths	0.72
Income from avoided DALYs	1.29
Environmental impact	
Value of reduced CO2 emissions	2.856
Value of biomass/forestry preservation	0.449
Net economic impact (excluding household savings)	6.5
Household savings	
Total household savings	2.9
Total net impact (including household savings)	9.4

6. Recommendations

For the Government to achieve its target of universal access to sustainable and clean electricity sources by 2030, 70% of the population, or approximately 4 million households, will need to gain access to off-grid solar products. Without any policy action from the Government, the uptake of solar products will be approximately half a million, with the remaining 3.5 million households having to rely on costly/polluting lighting sources, such as battery powered flashlights and kerosene lamps.

Similarly, it will be very difficult for the Government to achieve the target of increasing the number of households that use improved cookstoves to 2 million by 2020 without any policy action. According to model estimates, if taxes and import duties are removed from improved cookstoves the 2 million access target will be met by 2028, otherwise it is projected that the target will not be met in the next 20 years.

The removal of taxation on improved household products reduces the cost to consumers, allowing everyone to access them, while also providing an incentive to private sector firms to enter the market. Without private sector investment, the deployment of such products would require large contributions from the national financial outlays.

The findings from this study suggest that there is a compelling argument in favour of eliminating VAT and import duties on eligible household energy products in Malawi for a 10-year period. Tax exemptions will not only benefit those involved in the market for clean household products, but they will also have a positive impact on the economy as a whole. Such benefits will include faster economic growth, higher employment, reduction in carbon emissions and health improvements for society's most vulnerable groups, particularly women and children. These quantified benefits will by far exceed the foregone import duties and VAT on the household energy products.

However, for this policy action to bring the desired outcomes it is important that the removal of taxes applies only to those products that meet certain quality standards. Without appropriate monitoring in place, it is highly likely that tax exemptions might lead to an increase in the importation of inferior products, in which case the benefits quantified in this study will not materialise.

ANNEX 1: Consultations held to develop this study

Christina Connolly, DFID Malawi

Joseph Kalowekamo, Department of Energy

Welton Saiwa, Director of technical regulation and renewable energy, Malawi Energy Regulatory Authority (MERA)

Ishmael Stan Chioko, MERA

Mphatso Kachule, MERA

Crispin Kulemeka, Ministry of Finance (MRA)

Samuel Martin, BIF

Lloyd Archer, United Purpose

Heather Campbell, United Purpose

Ezgi Basar, GIZ

Christa Roth, Food and Fuel

Jones Ntaukira, ZUWA Energy

Morton Kanwda, Commodity Energy Malawi (CEM) Trading

Emmanuel Nambala, Sustainable Options Limited (SOL)

Giel de Pooter, Distributor of Envirofit cookstoves