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MODERN COOKING FOR HEALTHY FORESTS IN MALAWI PROSPECTS FOR EXPANDING ETHANOL AS A RESIDENTIAL COOKING FUEL IN MALAWI

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Cover Photo: Marketing “MotoSafi” ethanol stoves in Tanzania, Consumer’s Choice Limited (with permission from UNIDO)

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ACRONYMS AND ABBREVIATIONS

CDM	Clean Development Mechanism
CER	Certified Emission Reductions
Ci-Dev	Carbon Initiative for Development
COVID-19	Coronavirus Disease 2019
CPA	Component Project Activities of a Program of Activities
DIV	USAID Development Innovation Ventures
EEP	Energy and Environment Partnership South and East Africa
ENA	Extra Neutral Alcohol
ER	Emission Reductions
ERPA	Emission Reductions Purchase Agreement
EthCo	Ethanol Company Limited
EUR	Euro
GEF	Global Environmental Facility
GHG	Greenhouse Gases
GoM	Government of Malawi
INDC	Intended Nationally Determined Contribution
ISO	International Organization for Standardization
LPG	Liquefied Petroleum Gas
MBS	Malawi Bureau of Standards
MCHF	Modern Cooking for Healthy Forests in Malawi
MERA	Malawi Energy Regulatory Authority
MFI	Micro-Finance Institution
MWK	Malawian Kwacha
NCS	National Charcoal Strategy
PoA	Program of Activities

RAMA	Raw Materials Initiative
REPP	Renewable Energy Performance Platform
SEforALL	Sustainable Energy for All
UK	United Kingdom
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
US	United States
USAID	United States Agency for International Development
USDA	U.S. Department of Agriculture
VAT	Value-Added Tax

EXECUTIVE SUMMARY

The vast majority of Malawians rely on traditional fuel sources for cooking and heating, with over three quarters of the urban population using illegal and unsustainable charcoal. The Government of Malawi (GoM) has prioritized a reduction in the unsustainable harvesting for wood fuels, and in particular has targeted a reduction in urban household consumption of charcoal through a range of clean cooking fuels and technologies. This report assesses prospects for expanding the role of ethanol as a residential cooking fuel by urban consumers. This report seeks to answer the following questions:

- a. Are the conditions in place for ethanol to expand as a cooking fuel for urban households in Malawi? If so why?
- b. If not, what changes would be needed for ethanol to become a viable cooking fuel for Malawi's urban households?

The conditions are not immediately in place to expand ethanol as a cooking fuel in Malawi because there is currently not a ready supplier of affordable cooking ethanol fuel in the country or availability of good-quality stoves. Although the country produces around 29 million liters of ethanol annually, its two major distilleries (Ethanol Company Limited [EthCo] and PressCane) are unable to meet the country's current demand, which is dominated by the blended automobile fuel mandate, due to a chronic shortage of feedstock. Yet due to the high price of the available feedstock and sub-optimal levels of production, the price of ethanol produced within Malawi is too high for significant numbers of urban consumers to afford to switch over to ethanol as a clean cooking alternative to illegal charcoal. In the current situation, any distribution startup seeking to set up a business to expand ethanol-based cooking would need to compete to access scarce supplies of unrefined ethanol from the pool supplying high-value ethanol products such as beverages and fuel blending alcohol. Although the distribution company could import ethanol and take advantage of the lower global prices of ethanol, this would require a minimum volume of imports to make sense and would necessitate political support from the government.

However, there is a case to be made for the GoM, with help from development partners, to support distribution enterprises to introduce ethanol-based cooking and make policy changes that would allow the expansion of this clean cooking alternative. The arguments for making this investment now are fourfold. Firstly, recent experiences from neighboring and other Sub-Saharan countries show that the stove technology and business models for distributing ethanol fuel have matured to meet the cooking needs of urban consumers better. Secondly, unlike many of its neighbors, Malawi already has the distillation and refining capacity in place to expand production of ethanol rapidly if the feedstock bottleneck can be overcome to supply the demand for cooking ethanol fuel. Thirdly, if the ethanol used for cooking can be produced in-country, volatility in future fuel prices that customers risk facing from petroleum-based imported cooking fuels would be reduced. Fourthly, once established, ethanol cooking can be scaled up relatively inexpensively since the investment into infrastructure to store and distribute fuel is favorable compared to that needed for competing modern cooking fuels such as liquified petroleum gas (LPG) and electricity.

High-efficiency ethanol stoves rated International Organization for Standardization (ISO) Tier 4 for clean burning and with cooking power and prices similar to mid-range LPG stoves are available in the international market. Once they are approved by the Malawi Bureau of Standards, these stoves can be imported through an international competitive tender. Ethanol fuel is available in small, affordable

quantities, in increments similar to charcoal purchases. That said, the upfront cost of stoves, which are significantly more expensive than the charcoal-fueled Jiko, has been found to be a barrier for low-income households to switch to ethanol-based cooking in other countries in Sub-Saharan Africa. Utilizing carbon revenue, limited to the voluntary market at present, to provide the stoves at an affordable discounted price could be an effective strategy to expand sales of stoves in Malawi, as it has been in these countries.

One pathway for establishing ethanol cooking in the country might be to start with a small commercial pilot to demonstrate the cooking fuel and technology in Malawi, using this pilot to raise awareness of ethanol as a viable, renewable, clean cooking fuel and to advocate for changes in the sector that would support scaling. If the business model is proven, the pilot can be expanded to reach a larger customer base, perhaps with a mix of imported or domestically sourced ethanol, whichever is less expensive, at the end of the pilot. Ethanol for the pilot could be purchased from either PressCane or EthCo. The less-expensive option will be “technical grade” ethanol that is produced by EthCo, as a by-product of producing beverage grade extra neutral alcohol (ENA). While this could still be a relatively expensive source of fuel compared to prices in neighboring countries, it is the most immediately available source of cooking grade ethanol in Malawi at present. Sourcing from a domestic distiller has the benefit of allowing the distributor to purchase fuel in small quantities and avoid importing relatively small amounts of ethanol early in the pilot before demand is fully established.

Global ethanol prices are currently around half the price of ethanol in Malawi; even after adding customs, transportation, and storage costs, imported ethanol would be cheaper. Importing ethanol could also be attractive for PressCane and EthCo as a practical way to supply the blending mandate for transportation fuel, as an alternative to importing molasses feedstock, with the associated concerns of seasonality and perishability. The new cost-plus pricing formulation approved by the Malawi Energy Regulatory Authority (MERA) might make this an attractive option for distillers. The GoM would need to be convinced to reduce import taxes and value-added tax (VAT) for this to be an attractive solution. The main arguments in favor of such a strategy would be that ethanol importation could be an interim solution, which would enable the distilleries to become profitable, operating at full capacity and ensuring their ability to supply the blending mandate in the country. Distillers would import hydrous ethanol that they would process in their factories into anhydrous fuel alcohol, maintaining a level of value-addition. Additional revenue and higher levels of profitability would allow the distillers to invest in their own feedstock farms for which they have not been able to raise capital in the past. Distributors of cooking ethanol would need to partner with a larger importer to have access to the lower global prices of ethanol. This could be one of the Malawian distillers or a commercial importer supplying a regional hub to have access to ethanol imported from the global market.

The long-term prospects for Malawi to produce sufficient ethanol, to meet both its blending fuel target and for supplying cooking fuel, at a price that can compete with global prices will depend on the country’s ability to grow sufficient feedstock. Investments are being made to bring substantial new land under cultivation to grow more sugarcane and other food crops, such as under the Shire Valley Transformation Program. These investments will likely take five to eight years to yield results. One note of caution is that large-scale expansion of sugarcane (or other ethanol feedstock) production for fuel would necessitate a serious evaluation by the government of potential food security considerations.

I.0 BACKGROUND

The vast majority (97 percent) of Malawian households rely on firewood and charcoal to meet their cooking and heating needs. One major reason for continued unsustainable dependence on forest-based biomass fuels is lack of access to clean, affordable alternative fuels. An active clean cooking sector in the country reached the Government of Malawi's (GoM) target to roll out 2 million efficient cookstoves by 2020 to reduce biomass consumption. The GoM is now working to establish new goals and targets for cleaner cooking. These include targets for urban and rural households, as well as institutional and productive uses. The Modern Cooking for Healthy Forests project (MCHF), co-funded by the United States Agency for International Development (USAID) and UKaid, sought to provide market information for private sector companies interested to market clean fuels and fuel-efficient cooking technologies to the rapidly expanding urban population in the country, as an alternative to illegal and unsustainable charcoal which as of 2018 was used by more than 76 percent of urban households for cooking and heating.

GoM policy documents have identified liquified petroleum gas (LPG) and electric cooking as the most promising alternative modern cooking fuels in the country suited to reduce pressure on biomass stocks. This report examines the prospects for scaling up ethanol as another alternative to play a part in the cooking fuel mix of the country.

Ethanol production in Malawi for blending with automotive fuel dates back to 1982 as an energy security response to the 1973 oil crisis. Malawi has the distinction of being the only African country that has consistently used liquid biofuels for transport for an extended period. Ethanol as a cooking fuel is, on the other hand, almost non-existent and little known in the Malawi market. Ethanol, supplied by Ethanol Company Limited (EthCo), was used to manufacture gel fuel for domestic cooking from 2002 to 2005, but became uneconomical for the manufacturers to continue. Use of ethanol in its liquid form was never practiced in Malawi as appropriate stoves were not available on the market (United Nations Development Programme [UNDP] Malawi, 2007). Several stove designs have been proposed for the market but have not expanded. Tests carried out on a prototype SuperBlu stove, which was specifically developed for the Malawi market, found the stove to be potentially appropriate for use but suffered from manufacturing problems, with further work required on safety, performance and emissions (Robinson, 2006). At present, no one supplies ethanol cooking fuel or good-quality liquid ethanol burning stoves in Malawi.

As a land-locked country that must import all its petroleum products, pay in hard currency, and transport fuels in tankers over long land distances, domestically produced bioethanol could be attractive as a cooking fuel in Malawi for many of the same reasons that it is seen to be attractive as a transportation fuel. If it could be produced in sufficient quantities to meet cooking needs and at a competitive price, ethanol fuel could create energy security for the country and buffer consumers against fluctuations in global prices of petroleum-related products. The bottlenecks related to ethanol supply and how they might be overcome are explored in Sections 1.3 and 1.4.

I.1 POLICIES AND PRIORITIES FOR CLEAN COOKING IN MALAWI

Government of Malawi policies prioritize the sustainable and efficient use of biomass and the promotion of clean alternative fuels for cooking and heating to reduce the pressure on the country's forests. While these alternative fuels have included LPG, electricity, paraffin, and biogas, bioethanol has largely been left out of the alternate cooking fuels discussion. Where it has been highlighted in

Malawi's clean energy priorities, the role of ethanol has largely been reserved for use in vehicular transportation rather than for cooking.

The National Energy Policy (2018) prioritizes several fuels for meeting the cooking needs of Malawians. At the same time, it recognizes that biomass will remain the primary source of energy for the foreseeable future and promotes its sustainable production and efficient use. GoM had set a target to roll out 2 million efficient cookstoves by 2020 to reduce firewood consumption, which it has successfully met. The Policy also recommends government incentives to promote alternative cooking fuels including electricity, LPG, paraffin, and biogas. Importantly, the Policy priorities include ethanol as a cooking fuel: "Government will support, encourage and promote the production of bioethanol and biodiesel for blending or stand-alone use in vehicles, as well as for cooking, lighting, etc. provided that such production does not threaten food security." The National Energy Policy prioritizes the need to overcome the shortage of feedstock to enable the country to meet its 20:80 ethanol to gasoline blending mandate along with promoting 100 percent bioethanol powered flex-fuel vehicles.

The Sustainable Energy for All (SEforALL) Action Agenda for Malawi (2017) set targets of 5 million efficient cookstoves, 120,000 electric cookers, and 54,000 LPG stoves by 2030, and a target of increasing fuel ethanol production to 40 million liters per year by 2030 aimed at increasing its use in the transportation sector. Ethanol gel fuel is mentioned as one among many alternative cooking fuels that the GoM will encourage the private sector to invest in, but no mention is made of promoting the use of liquid ethanol as a cooking fuel. The Malawi Renewable Energy Strategy (2017) proposes biogas and biomass briquettes as the most promising among renewable energy cooking technologies. Biofuels are seen as a renewable energy solution exclusively for the transportation sector.

The National Charcoal Strategy 2017-27 (NCS) identifies LPG as the most promising alternative fuel to urban charcoal use in the medium term. The NCS makes no mention of ethanol, however, as a potential cooking fuel for the country. In the short term, the NCS sees the increase of efficient cookstove use as the most promising solution: "Increasing adoption of fuel-efficient charcoal and firewood cookstoves presents the most immediate option to slow deforestation and forest degradation across Malawi" (Republic of Malawi, n.d., p. 17). In the context of prevailing chronic power shortages in the country, the NCS sees scaling up of electric cooking as only possible in the long term once investment into power generation can be attracted from independent power producers and rural electrification is significantly expanded.

Malawi's international climate change commitments include targets for expanding production of biofuels. Increasing bioethanol production from 18 million to 40 million liters per year, primarily for increasing the ethanol to gasoline blending ratio, is listed in the Intended Nationally Determined Contribution (INDC) document as conditional on receiving external investment for capacity building, technology, and finance. The INDC also includes promotion of "bio-fuels for lighting and cooking replacing fossil-based fuel" (Republic of Malawi, 2015, p. 10) as an unconditional action by the GoM.

1.2 HOUSEHOLD COOKING DYNAMICS IN URBAN MALAWI

According to the Urban Cooking Energy Consumer Market Research and Baseline Survey carried out by MCHF between August and October 2020 (USAID and UKaid, 2020a), the majority of homes in urban areas of Malawi cook with unsustainable, illegal charcoal (86.3 percent). Approximately 25 percent of households use one or more modern fuels for the majority of their cooking (23.5 percent use electricity, and 1.8% use LPG). No users among the sample surveyed reported using ethanol fuel or had heard of its application for domestic cooking, compared to 33.7 percent that had heard of

LPG and 95.8 percent that knew of electrical cooking. This makes it clear that expanding ethanol cooking will require significant investment into increasing awareness among prospective users.

The MCHF survey found that the average net price of charcoal without dust varies from MWK 114 in Salima to MWK 218 in Lilongwe and the average household spending varies considerably ranging between MWK 280 and MWK 634 per day, depending on the price of charcoal and average consumption in the city. Table 3 (page 14) shows that the price of illegal charcoal in Malawi might currently be too low for modern fuels such as LPG and ethanol to compete with it strictly on price comparisons. That said, it would make the most sense to introduce alternative clean fuels in Lilongwe, where the price of illegal charcoal is the highest. As the MCHF survey documents, those consumers who prioritize switching to improved cooking stoves and fuels will have additional motivations, such as speed of cooking, fuel efficiency, accessibility, cleanliness, lack of smoke, modernity, and safety.

1.3 CURRENT LEVELS OF ETHANOL PRODUCTION CAPACITY, FEEDSTOCK, AND PRODUCTION LEVELS

An understanding of ethanol and grades of product is required to put the following discussion into context. Ethanol, also known as alcohol, is a colorless, volatile (evaporates easily), and flammable liquid that is soluble in water. The compound can be classified as a hydrocarbon; however, it is not sourced from fossil fuel. Ethanol is produced by fermenting sugars, including from starches that are processed to break down into a sugar, and distilling to concentrate the product. The ethanol grades discussed in this report are defined below:

- *Rectified alcohol* (rectified spirit) is a concentrated ethanol with a purity of 95 percent (5 percent water) and very low levels of impurities. This first level output from the distillation process is the basic building block for other applications such as beverage grade or anhydrous ethanol used for fuel blending. Rectified ethanol would provide a very high quality of fuel for domestic cooking.
- *Extra Neutral Alcohol* (ENA) is a 95 percent, food-grade alcohol used as a feedstock for making alcoholic beverages. ENA is produced by further processing rectified alcohol to produce a colorless alcohol, with no impurities and a neutral smell and taste.
- *Blending alcohol* or anhydrous ethanol (>99 percent) is produced by removing the remaining water from rectified alcohol through an additional complex process to make it suitable for use in an internal combustion engine.
- *Technical ethanol* is also high-concentration ethanol, usually 95 percent, but it usually has higher concentration of impurities. It is produced almost as a by-product or low-quality rectified spirit remaining at the end of production of ENA and demands a lower price. Depending on level of impurities, technical ethanol can be used directly in stoves or after mixing with methanol to produce a clean blue flame.

Malawi has two active distilleries producing fuel-grade ethanol for blending with gasoline to reduce the country's petroleum imports and other products: Ethanol Company Limited (EthCo) and PressCane Limited. The distilleries have a close relationship with the sugar factories, as distilleries purchase their primary feedstock (molasses) from the factories. EthCo additionally sources steam and water for its processing needs from Dwangwa Sugar Estate. Press Corporation PLC, the largest business conglomerate in Malawi, is the major shareholder in both EthCo and PressCane.

EthCo was established in 1982 next to the Dwangwa Sugar Estate, 306kms north of Lilongwe on the Northern Lake shore in the mid-central region of the country. EthCo is the country’s sole producer of ENA, which EthCo supplies to the beverage and pharmaceutical sectors. EthCo currently produces around 12,000 liters a day of technical ethanol, which it refines to manufacture fuel-grade anhydrous alcohol for blending with gasoline. The ENA is supplied to bottlers in Malawi and exported to beverage companies in neighboring countries.

PressCane Limited, commissioned in 2004, is located about 60km south of Blantyre. The Nchalo Sugar Estate is located 20kms further south; both are located in the district of Chikhwawa, in the southeast of Malawi. PressCane is Malawi’s leading producer of automotive fuel-grade ethanol and supplies rectified spirits to the industrial chemicals market.

Annual production of ethanol varies from year to year but has remained below the original nameplate capacities, also referred to as the maximum production capacity, of 14 million liters for EthCo and, following a 2017 upgrade, 27 million liters for PressCane (previously 16 million liters, per the Press Corporation PLC 2015 Annual Report). The upgrade increased PressCane’s nameplate capacity from 60,000 to 90,000 liters of rectified spirit per day (Press Corporation PLC, 2019). PressCane produced at record-breaking levels of 16.7 million liters in 2018 and 17.8 million liters of ethanol in 2019 (ibid.), but the company is still producing at only 66 percent of its new maximum production capacity. EthCo produced 11 million liters in 2018, around 78 percent of its maximum capacity.

The main reason for below-capacity production is a long-running shortage of molasses feedstock within Malawi (Press Corporation PLC, 2013, 2014, 2015, 2016, 2017, 2018, and 2019). Illovo, the owner of the two sugar mills, produces 90,000 metric tons of molasses at full mill capacity, all of which it sells to the two distilleries (Email communication with Mr. Luis Fernandes, the Export Manager – Downstream based in South Africa, with responsibility for the sale of molasses and ethanol in Illovo mills in Malawi). EthCo purchases additional molasses from Salima Sugar Factory (within Malawi) and imports from Zambia; PressCane imports molasses from Zambia and Mozambique at present to make up for the partial shortfall in feedstock.

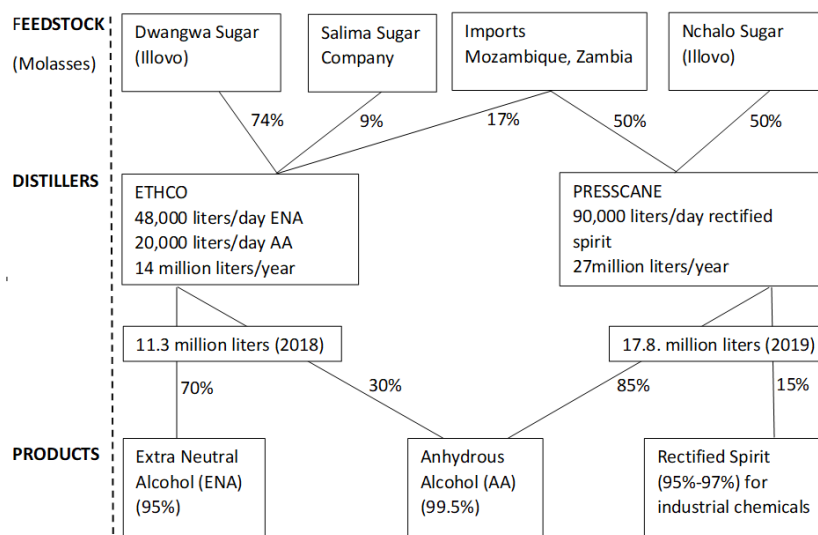


FIGURE I: CURRENT LEVELS OF ETHANOL PRODUCTION FROM ETHCO AND PRESSCANE

Sources: Press Corporation PLC Annual Reports, 2013, 2014, 2015, 2016, 2017, 2018, and 2019; EthCo Annual Integrated Report, 2019; Field Notes from Industrial Visit to PressCane, November 2020.

I.4 FUEL SUPPLY CONSTRAINTS FOR SCALING UP ETHANOL-BASED COOKING IN MALAWI

Two factors stand in the way of scaling up ethanol-based cooking using domestically produced ethanol in Malawi. Firstly, as previously described there is a long-running shortage of supply of ethanol in Malawi. Secondly, the ethanol produced in-country is around twice as expensive as regional and global prices of ethanol. The primary reason for both the shortage in supply and the high price of ethanol in Malawi is insufficient and excessively priced molasses feedstock.

Additional molasses could be imported from Zambia and Mozambique, but high prices and costly transportation make the option unviable at the regulated prices for fuel ethanol. Importing molasses from neighboring countries has not been able to improve the feedstock prices significantly due to prohibitive overland transportation costs. For example, the PressCane Chikhwawa factory pays \$75 per ton of molasses sourced from the Nchalo Sugar factory, but can import at \$30 per ton from Zambia and \$35 per ton from Mozambique (based on conversations during the site visit to PressCane factory in November 2020). PressCane and EthCo prefer to solve the feedstock problem through promoting growing additional sugarcane primarily targeted for ethanol production (interview with Dr. Christopher Guta, CEO of PressCane).

The price of fuel-grade ethanol is regulated by the Malawi Energy Regulatory Authority (MERA) and until recently has been tied to the imported price of petroleum. During times of relatively low global prices of petroleum, as has been the situation for the past seven years (e.g., 2014-2020), the margins on the production of fuel ethanol can be thin and sometimes negative. This is particularly a problem when the price of molasses feedstock remains high while the regulated ethanol prices are held low by international petroleum prices. Responding to petitions by the distilleries, MERA amended the regulation in mid-2020 that tied fuel ethanol price to world petroleum price and will make a determination on the price based on a cost-plus margin pricing model. The distilleries believe that the new pricing model will make the production of fuel ethanol more viable for them and they are confident there will be significant room for market growth to meet the Government's 20 percent blending mandate and desire to promote flex-fuel vehicles.

This regulatory change is unlikely, however, to result in availability of affordable cooking ethanol fuel in the near future. Unless the distilleries have access to higher volumes of lower-cost molasses, the regulated price of ethanol is likely to go up rather than down, consistent with the motivation that led to the distilleries making the petition in the first place. Given the 20 percent blending mandate (which is far from being met) and the higher price of ethanol that the blended fuel market can absorb, unless they are required to do so, the distilleries are likely to sell any additional ethanol they produce to first supply the unmet demands in that market rather than producing ethanol for the lower value cooking market. The analysis in Section 2.0 of the report will show that the price will need to be no more than around US \$0.85 per liter for ethanol to be competitive against LPG in the Malawi market. For comparison, the gate price for anhydrous ethanol for fuel blending is reportedly currently \$1.00 per liter.¹ The distilleries have suggested that they would be prepared to set aside a proportion of their production for cooking fuel should the government order them to do so (meeting with Dr. Christopher Guta, CEO of PressCane). MERA could increase access to ethanol-based cooking for low-income households by requiring distilleries to set aside a percentage of their

¹ Converting from technical ethanol to 99 percent anhydrous ethanol is estimated to cost around US\$0.11 per liter. Anhydrous ethanol will be more expensive by another 4 percent due to reduced volume.

rectified and technical ethanol production for cooking at a gate price low enough to make ethanol affordable for lower-income households.

While the recent regulatory changes (which allow the distilleries to cover their cost of production) provide a way forward for Malawi to make progress toward meeting its blended fuel mandate, it provides only a partial solution for expanding ethanol-based cooking unless the problem of supply of reasonably priced feedstock can be resolved. This report presents below potential short-, medium- and longer-term solutions to address this challenge. One short-term solution could be for EthCo to provide a portion of the technical alcohol they produce, as a byproduct of making ENA, to help demonstrate the market for ethanol cooking. Ms. Lusubilo Chakaniza, CEO of EthCo, informed the study team that the company does indeed produce around 12,000 liters a day of technical-grade alcohol along with 48,000 liters of ENA. At present, the company refines all of its technical alcohol by-product to produce fuel ethanol for the transportation sector and is not able to set any aside for the cooking sector at a lower price than what the company currently receives for transportation fuel, which is currently around \$1.00 per liter, minus processing costs.

Based on typical costs to refine technical ethanol to fuel-grade ethanol, the study team estimates that EthCo could profitably sell a portion of their unrefined technical ethanol to supply the cooking market at around US \$0.85 per liter. Half of EthCo's daily production of technical ethanol would meet the cooking needs of 12,000 households at an average consumption of 15 liters per month. It is unlikely that such a large number of households can afford to switch to ethanol-based cooking if the fuel prices remain at this relatively high level. Since an optimistic number of adopters might be around 6,000 households, the study team would expect that at most there would be demand for around one-quarter of EthCo's production of technical ethanol to supply the cooking market. For comparison of fuel prices, Consumer's Choice pays US \$0.48 per liter to purchase rectified ethanol from Illovo's Kilombero distillery in Tanzania and is able to provide fuel to consumers at an average retail price of under US \$0.87 (based on conversations with Project Gaia).

A second immediate solution would be for a startup distributor in Malawi to partner with an ethanol-cooking project in Kenya and Tanzania and import small amounts of ethanol fuel to demonstrate a demand for ethanol cooking; in the range of two to four 20,000-liter isotanks of ethanol each month. The next section of this report (1.5) describes several large stove programs that are successfully growing their programs with ethanol sourced from distilleries in East Africa or from overseas imports.

Importation of ethanol into Malawi should be considered for several reasons. Firstly, since Malawi must import feedstock for its distillers to supply its blending mandate fully, it makes sense for the country to consider importing hydrous ethanol, which is roughly 20 percent of the weight and 25 percent of the volume of molasses. The high cost of transporting molasses overland is evident by the large difference in price between locally sourced molasses versus importation from Zambia and Mozambique. Ethanol is a globally traded product available at a competitive price from suppliers as diverse as Brazil or the United States. The U.S. spot market price for rectified ethanol on January 18, 2021 was \$0.42 per liter ("Ethanol PRICE Today," 2021), which is close to the highest it has been in the past five years and yet is significantly lower than the price in Malawi. Ethanol trader Tradhol Internacional estimates that 95 percent hydrous ethanol can be delivered to Chikhwawa or Dwangwa at a price of around \$0.74 per liter² delivered duty paid for a shipment of 5 million liters,

² Assuming a price of \$0.545/liter (cost, insurance and freight in Tanzania + storage (\$0.02) + inland trucking (\$0.15) + trader's fee (\$0.025).

assuming a customs duty of 5 percent as an industrial chemical. The GoM would need to decide to waive the country's 16.5 percent value-added tax (VAT) for large-scale importation to make sense.

PressCane or EthCo could import hydrous ethanol at volumes of 5–10 million liters, which is feasible for bulk delivery from a shipping perspective.³ These are the only companies with need for such large volumes of ethanol at present in Malawi. Start-up cooking distributors could access a small portion of this until their market expands sufficiently for them to import directly. If the source of the imported ethanol were the United States, the U.S. Department of Agriculture (USDA) is able to support the transaction with a facility that allows a qualifying African client 180 days to pay for a load of ethanol through their Export Credit Guarantee Program, GSM102 (see <https://www.fas.usda.gov/programs/export-credit-guarantee-program-gsm-102>). The USDA also has a program that will underwrite finance for port infrastructure with a loan guarantee (see <https://www.fas.usda.gov/programs/facility-guarantee-program>).

The model of developing demand for cooking ethanol by starting with imported fuel at low tariffs and using the demonstrated demand to attract investment into domestic distilleries to supply this demand is one that has been demonstrated in other contexts. *Scaling Up Clean Cooking in Urban Kenya with LPG & Bio-Ethanol* (Dalberg, 2018) points to the Kenyan beverage alcohol market where imports were used to prove latent demand. Local molasses producers built bio-ethanol plants to serve the beverage market once the demand became clear. Per Dalberg, there are now three bio-ethanol producers in Kenya, producing 50 million liters annually and exporting to Uganda and Tanzania. Once the demand is established for cooking ethanol, PressCane and EthCo can choose to supply this market if they have sufficiently expanded their production. The relatively lower-quality specification of cooking ethanol, compared to blending or beverage alcohol, provides an opportunity for micro-distilleries to supply the cooking market at volumes of 1–2 million liters per year. Micro-distilleries present an investment opportunity for the private sector in Malawi and can use feedstock ranging from cane juice to sweet sorghum or cassava produced by smallholder farmers.

A longer-term domestic solution to reducing imports of feedstock will need to come from increasing sugarcane production within Malawi. EthCo and PressCane are investing in the production of their own feedstock, investing jointly with local sugarcane farmers to meet future needs. EthCo reports that they will be investing in their milling plant by 2023, and in a new refinery expanding fuel-grade production by 2025–2030. Although actual production of cane remains low to date, PressCane has also invested in its own sugar cane farm and signed agreements with smallholder out-growers as a long-term strategy to increase supply of cane syrup as a raw material feedstock (Press Corporation PLC, 2013, 2014, 2015, 2016, 2017, 2018, and 2019). The distilleries are currently sending the sugarcane they source from their agreements with smallholders to the Illovo sugar mills for crushing but they expect to crush cane themselves once their own mills are installed.

Starting in 2013, PressCane and EthCo had tried to put in place an ambitious initiative called RAMA (for Raw Materials) to develop their own feedstock supply. This was abandoned on account of change in regulations in terms of packaging and distributing drinking alcohol in the country at the time and due to the challenges of raising capital. It is possible that the new MERA regulations on ethanol pricing could make it easier to raise capital for expanding cane production. Apart from potential investment by the distilleries themselves, the most likely prospects for substantial increase

³ A good model for distilleries importing ethanol exists in Nigeria where two large distilleries in Apapa (Lagos) reprocess crude ethanol for resale to the rectified ethanol markets in and outside of Nigeria. Almost 300 million liters of ethanol were imported to Nigeria in 2019 to be reprocessed for value addition. Both companies involved in this business are building large distilleries inland, based on sugarcane and cassava feedstocks. The motivation for these distilleries includes FOREX considerations, policy shifts in favor of local production, and reliability of supply. This example of Nigeria shows imports do not hold back local development of the sector but rather encourage it. (Source: personal communication with Harry Stokes of Project Gaia).

in sugarcane production in the country come from the Shire Valley Transformation Program (Interview with Mr. Bouke Bijl, Agricane). The Program funded jointly by the African Development Bank and the World Bank is providing investment into gravity fed irrigation, drainage and land tenure to support 56,000 smallholder farmers to increase agricultural productivity and commercialization. The program has an objective of bringing 18,000 ha of new land under sugarcane cultivation but this \$200M project is 5-8 years away from being completed.

While expanding sugar cane cultivation promises to increase jobs for farmers, using agricultural land for growing fuel can reduce food security for Malawi. The National Energy Policy is clear that it supports “Increasing local capacity to produce bioethanol and biodiesel fuels without threatening food security, especially through the collaboration of farmers’ cooperatives, women farmers’ coalitions, and other marginalized groups.” The Policy notes that staple food crops such as maize and cassava are currently not used to produce ethanol fuel.

1.5 STATUS OF ETHANOL-BASED COOKING IN THE REGION

The earliest ethanol cooking project to achieve scale in Southern Africa was CleanStar Mozambique. Undertaken with private investment from Denmark-based Novozymes, which specializes in industrial biological solutions using enzymes and microbes, and CleanStar Ventures plus additional resources from the Soros Economic Development Fund, making a total investment of \$20 million (Siegel, 2012), it received fanfare when it launched in 2012 as “an integrated food, energy, and forest protection business that works with farmers to grow a variety of crops that it then processes into food and cooking fuel products for sale in local markets,” and a “Soros-backed project to get rid of dirty charcoal cooking fuel and create jobs in the process” (Schwartz, 2012). The distillery was designed by the US-based engineering firm ICM to convert cassava grown by smallholder farmers into ethanol (Biello, 2012). Difficulties associated with sourcing sufficient cassava from smallholders locally and transportation challenges to collect cassava from neighboring districts led to the distillation unit shutting down in November 2013. Even while producing ethanol locally was proving to be challenging, cooking with ethanol proved popular and stove sales in Maputo reached 3,000 per month at its peak. With no production in Mozambique, ethanol produced from molasses had to be imported from South Africa to fuel the 33,000 stoves the program had already sold. The high cost of fuel imports and delays in collecting carbon revenue, in anticipation of which stoves had been sold at a subsidized price, resulted in losses and eventual declaration of bankruptcy by Novozymes, CleanStar Ventures and partners. Local investors, led by Thelma Venichand, former sales and marketing director for CleanStar Mozambique, purchased the part of the business that covered the sales of ethanol. Sadly, following the collapse of the Mozambique economy and deterioration in currency value, the price of imported fuel rose to an unsustainable level and operations were eventually suspended.

Building on his experience as Chairman of CleanStar Mozambique, CEO Greg Murray launched the ethanol cooking company KOKO Networks (see <https://kokofuel.com/>) in 2013, with new investment from CleanStar Ventures, to supply customers in Nairobi, Kenya. In the analysis of the expansion of bioethanol cooking in Nairobi, Dalberg (2018) points to KOKO Network having adopted a V2.0 “Smart Fuel ATM” approach learning from the limitations of the V1.0 “Centralized Bottling” approach that was used to supply Maputo. Dalberg highlights the following innovative elements of V 2.0: a) technology-enabled distribution and b) utilization of downstream distribution infrastructure. KOKO Networks, which describes itself as an international technology company and a global leader in clean ethanol cooking, has designed and developed a proprietary filling system that allows bottle refills at ethanol vending machines known as KOKO Points that identify the customer via a microchip in the bottle and allow for cell phone-based digital payments. KOKO set up 700

KOKO Points in and around Nairobi (Wilson, 2019). Dalberg estimates that the technology-enabled distribution can reduce combined distribution and retail cost by approximately 45 percent over the VI.0 setup. KOKO Network partnered with Vivo Energy, which operates Shell-branded gasoline stations, for bulk storage and supply of ethanol to the distribution kiosks. V2.0, designed for rapid scale up, led to the company announcing that 50,000 households had switched to KOKO fuel by August 2020 (KOKO Networks, n.d.). To address constraints of ethanol supply, and the resulting fuel price instability in the market that can result with growth in demand, KOKO Networks diversified their sourcing of ethanol fuel to include both local supply and imports. While the company started out sourcing ethanol from distilleries mostly in Kenya and from Tanzania and Uganda (Collins, 2019) they have recognized the risk of price rises with rapid expansion of the market. Through Vivo Energy, KOKO imported a shipment of ethanol in 2020 from the global market and are reportedly in negotiations to import a second shipment in 2021.



KOKO Networks Ethanol Stove/Fuel offer, Nairobi, Kenya. Source: <https://kokofuel.com/>

Green Development, a Norwegian carbon credit trading company, has taken an approach to expand ethanol-based cooking throughout Sub-Saharan Africa using a carbon finance platform. They supply high-quality Blue Flame Stoves products⁴ at a discounted price made possible through carbon credits. Harnessing the potential of new technology, Green Development requires its distributors to track customers and cookstove/fuel sales through a smartphone application specifically designed for the purpose.



The Blue Flame carbon credit-supported ethanol stove. Source: <https://www.blueflame.no/>

While their operations were started in Madagascar with the objective of reducing deforestation, their Program of Activities (PoA) registered with the Clean Development Mechanism (CDM) includes a total of 57 Component Project Activities (CPAs) in another 18 countries in Sub-Saharan Africa, including Malawi. Certified emission reductions (CERs) post-2020 currently have no clear market given the uncertainty of the future of the CDM following the end of the second commitment period of the Kyoto Protocol at the end of 2020 (Chagas, Greiner, and Hunzai, 2017). Project developers may be eligible to transition their registered PoAs and CPAs to voluntary carbon market platforms such as the Gold Standard as long as they claim emission reductions of a given vintage only once, under one single scheme.⁵ One of the company’s Emission Reduction Purchase Agreements (ERPAs) is with the Carbon Initiative for Development (Ci-Dev), a World Bank trust fund that mobilizes private finance for clean energy access in low-income countries (“Madagascar: Ethanol Cookstoves,” n.d.). Ci-Dev has agreed to purchase 850,000 emission reductions (ER) from 35,000 stoves in Madagascar. Ci-Dev is a post-Kyoto fund that chose to follow the CDM methodology, but is not purchasing credits for the compliance market, and will honor ERPAs for their full life. The most recent monitoring report completed in April 2020 shows that Green Development had distributed close to 9,000 stoves in Madagascar and another 22,000 stoves in Kenya under the PoA.⁶

⁴ Blue Flame Stoves notes that more than 55,000 of their stoves have been distributed in Kenya, Tanzania, and Madagascar under the SAFI brand in partnership with Green Development. See <https://www.blueflame.no/>

⁵ See <https://www.goldstandard.org/resources/faqs> for a response to “How can CDM projects transition to the Gold Standard?”.

⁶ Monitoring report form for CDM Programme of Activities <https://cdm.unfccc.int/filestorage/P/N/D/PNDTZMHKBELS18UXJ234YWQR906VIG/Monitoring%20Report%20Kenya%20and%20Madagascar%20%5B1%5D.pdf?t=YU98cW9oYWIvfDCRy9HPjuniTHd7typcTCpf>

In addition to Ci-Dev, Green Development partnered with Samsung Electronics, which purchases ERs from 20,000 stoves being used in Kenya. The CPAs in the other countries, including Malawi, do not appear to be active at present. With the achieved scale-up, the supply of ethanol fuel has become a major constraint in Madagascar. The company, together with the Ci-Dev team at the World Bank, has reportedly been in conversations with other stove distributors in the region to see how they might jointly have access to imported ethanol through a fuel supply hub in the region, which could receive bulk deliveries sourced from the international market. Small deliveries would go out in drums or isotanks to stove projects around the region.⁷ Once a private bulk distributor steps up to set up such a mechanism, stove projects in Malawi could also have access to it.

With funding from the Global Environmental Facility (GEF), the United Nations Industrial Development Organization (UNIDO) launched a project designed to support the commercial supply of 500,000 stoves in Dar es Salaam in five years. The first tender for distributing 110,000 ethanol stoves along with the fuel for them was won by a local company, Consumer's Choice, which had their project kick-off in June 2019. The project envisions local assembly of stoves from imported kits and sourcing of ethanol both nationally and regionally. The project design rewards the distributor with a results-based-grant incentive, through a local participating bank, upon demonstrating evidence of sale of stoves. UNIDO plans to engage additional distributors to reach its targets possibly expanding distribution to other cities in Tanzania. UNIDO also expects to trigger similar programs in another 20 countries in Sub-Saharan Africa through technical assistance based on the experience in Tanzania ("UNIDO Collaborates with TIB Development Bank," 2019).



Consumer's Choice Limited Ethanol Stove/Fuel offer, Dar es Salaam, Tanzania. UNIDO.

Despite challenges from the Coronavirus Disease 2019 (COVID-19) pandemic, Consumer's Choice had sold around 2,000 CLEANCOOK stoves by the close of 2020 under the brand name MotoSafi (About Us – CLEANCOOK Sweden AB, n.d.). The CLEANCOOK stoves are imported from South Africa in kit form and assembled in Dar es Salaam. Having a large contract allowed UNIDO to negotiate a competitive price for the stoves. UNIDO further reduces the price to consumers through a partial subsidy to buy down the cost of the stove. Consumer's Choice currently sources its ethanol from the Kilombero Sugar Factory and other domestic distilleries in Tanzania but is interested in diversifying its source of ethanol, including through imports from outside the region, as its stove numbers grow (as reported by Project Gaia). Consumer's Choice uses a more conventional fuel distribution modality using standard plastic bottles and paying retailers a margin of around 10 percent of final price to stock and sell the fuel. The company has its own trucking company subsidiary that it uses to distribute ethanol. Given the smaller expected size of the market in Malawi for ethanol cooking, distributors can choose to keep their investments low by starting with a similar, less capital-intensive modality while initially creating demand for ethanol-based cooking.

⁷ As reported by Project Gaia, discussions are ongoing with the Spanish trading company Tradhol Internacional (<http://www.tradholint.com/web/en/trading-2/326-2/>) to invest in a regional ethanol hub to supply biofuel markets in Kenya, Tanzania, and Madagascar with imports from Eswatini or from the international market.

2.0 MALAWIAN COOKING ETHANOL MARKET ANALYSIS

Successful promotion of ethanol cooking at scale in Malawi is contingent on the availability of a reliable supply of affordable fuel. Sections 1.3 and 1.4 of this report detail the challenge of immediately expanding ethanol-based cooking in Malawi using locally sourced fuel. The study team proposes that a commercial pilot is initially needed to increase awareness of ethanol-based cooking and to test the attractiveness of this modern cooking fuel in urban areas of Malawi. The team shows in Section 1.4 that while systemic changes are needed to produce and supply ethanol at a price low enough to expand the market for ethanol-based cooking substantially, technical ethanol produced by EthCo is best suited to supply the pilot. In this section of the report, the team presents the market analysis that would justify launching the pilot.

2.1 HOUSEHOLD COOKING MARKET CONTEXTUAL INFORMATION

This section summarizes the urban cooking ecosystem in which an ethanol-based cooking distribution enterprise would need to compete. The study team's primary assumption is that ethanol cooking would need to be introduced first to middle-to-higher-income households situated within urban areas. Given the cost of modern fuels like ethanol and LPG, sustainable commercial sector-based delivery must be focused on the markets with the ability to pay and lowest distribution costs associated with high-density living. An overview of the Malawian urban domestic cooking fuel market is presented below, drawing from a range of sources.

2.1.1 GENERAL COOKING HABITS AND TRENDS (USAID AND UKAID, 2020A AND C)

- Changes in the Malawi's urban cooking landscape have been noted in recent years—most notably the considerable increase in urban household reliance on illegal and unsustainably produced charcoal, which has been augmented by urban migration and population increase—raising the need for government, and development partners to add urban cooking solutions to the previous rural-only focus.
- Use of charcoal as the primary cooking fuel in urban Malawian households increased from 44.6 percent in 2011 to 76 percent in 2018 (2018 Malawi Population and Housing Census, 2019).
- Charcoal use is estimated to be increasing 10 percent per year in Malawi.
- The Jiko (charcoal stove) is widely used for cooking.
- LPG is used in urban areas but limited to around 15,000 households.
- Ethanol-based cooking is practically non-existent in Malawi and very few people have heard of this application of ethanol.
- Electricity provides the main modern cooking fuel in Malawi with some 23.5 percent of households doing 50 percent or more of their cooking on it; however, shortage of power and grid reliability issues have lowered its popularity. LPG is the second-most-used modern cooking fuel with 1.8 percent using it for 50 percent or more of their household cooking.

- “Stove stacking” and “fuel stacking” are common in Malawi, whereby households receiving modern cooking technologies still revert to traditional methods/fuels.
- Cost is among the primary drivers for ongoing illegal charcoal use in urban areas.
- Existing fuel price trends include:
 - Over the past five years, charcoal costs have increased more than three-fold, likely to be the result of increasing demand for charcoal as urban populations grow and decreasing charcoal supply due to continued deforestation in Malawi.
 - Electricity prices have doubled in the same time frame.
 - LPG prices had been generally stable for the past five years with minor increases (including in December 2020) more than offset by the removal of customs, duty and VAT on LPG in 2019.

2.1.2 SURVEY OF STOVE AND FUEL PRICES

At the heart of any market offer is the attractiveness of the new product and its competitive position against a baseline of existing alternative offerings. This section compares the performance, purchase price, and operating cost of ethanol stoves with other modern fuels currently utilized in Malawi.

Performance of Ethanol Stoves

Stove type selection is important for successful adoption. The ethanol cookstoves being used in the regional programs described in Section 1.5 perform comparably with LPG. They provide similar cooking power as mid-range LPG stoves and similar or better power regulation, which is the measure of how well the flame can be controlled. The Blue Flame Stove being marketed in Kenya and Madagascar by Green Development has a firepower rating (i.e., the input power to the stove) of 1.55 kilowatts (kW); the Comet-I stove from CLEANCOOK being marketed by Consumer’s Choice in Tanzania has a firepower rating of 1.8 kW. At a conservative thermal efficiency of 60 percent, these stoves would deliver cooking power (i.e., the power available to the contents of the pot) of 0.93 kW and 1.08 kW, respectively. Guofeng Shen of the Office of Research and Development at the United States Environmental Protection Agency and colleagues tested five different residential LPG stoves (Shen et al., 2019) and measured cooking power ranging from 0.7 kW to 1.5 kW. The Blue Flame and Comet-I stoves fit in the middle of this LPG performance range. The cooking power at the low power setting of the five tested LPG stoves ranged from 0.35 kW to 0.75 kW or around 50 percent of the maximum power output. The ethanol stoves typically have a relatively lower low setting than LPG stoves, allowing for better fuel efficiency during simmering. The low power setting of the Comet-I stove is around 0.18 kW, for example, which is around one-sixth of the maximum power of the stove.

Stove Price Comparisons

Stove prices include the costs of obtaining all parts for cooking application needed before cooking can commence but excluding any fuel cost. Table 1 (next page) shows the results of a basic market survey carried out in Blantyre in November 2020 for comparison purposes. Retail prices for Comet-I and Comet-2 CLEANCOOK ethanol stoves are estimated by including VAT and excise tax to be

comparable to other stoves. No customs duty has been included in the price since they would be imported from South Africa.

TABLE 1: STOVE PRICES

STOVE		US\$	MALAWIAN KWACHA (MWK)*
Envirofit Smart Saver efficient charcoal stove		30.26	23,000
LPG Single Plate Burner & Pot Ring, with 5 kilogram (kg) Cylinder; Customer Owned – No Gas		80.53	61,200
LPG Double Plate Cooker, Regulator/Pipe Plus 9kg Cylinder; Customer Owned – No Gas		93.03	70,700
Electric Stove – Double Plate		20.00	15,200
Electric Stove – Single Plate		10.30	7,904
Ethanol Stove – Single**		40.75	30,970
Ethanol Stove – Double**		75.35	57,266
* Exchange rate of MWK to US\$ as of November 2020		1.00	760

**Ethanol stoves are estimated based on imports of less than 1,000 units at a time

Fuel Price Comparisons

The study team determined the current fuel prices in Blantyre (Table 2), using the following information: electricity is based on published prices for a standard household tariff, the TI schedule as of March 2021; and LPG prices increased in December 2020 to MWK 1,880 per kilogram (kg).

TABLE 2: TI SCHEDULE

TARIFF CODE	DESCRIPTION	TYPE OF CHARGE PER MONTH	EXISTING RATE (MWK)	NEW RATE (MWK)
ETI	Domestic, Prepaid, Single Phase Supply	First 50 kilowatt hours (kWh) Unit Charge	47.50	56.00
		Above 50 kWh unit charge	67.25	79.30

Charcoal prices in MWK/kg are taken from the recently completed consumer survey carried out by MCHF (USAID and UKaid, 2020a). Table 3 shows significant variation in the average prices of charcoal in the cities of Lilongwe, Blantyre, Mzuzu, Zomba, and Salima. The survey documents large variations in price within each city as well based on location of the size of unit pack purchased. Variations also occur across seasons with charcoal prices increasing during the rainy season.

TABLE 3: CHARCOAL PRICES (USAID AND UKAID, 2020A)

MEAN PRICE IN MWK	LILONGWE	BLANTYRE	MZUZU	ZOMBA	SALIMA	TOTAL
Charcoal as bought (with dust)/kg	207	173	139	169	109	164
Charcoal net price (with dust removed)/kg	218	178	165	172	114	173

To compare the effective price of different fuels compared to charcoal, this study uses charcoal prices in Lilongwe and Blantyre, the two cities with the highest prices of illegal charcoal and the largest number of households likely to adopt cleaner cooking.

2.2 PRICE COMPETITIVENESS OF ETHANOL AS A COOKING OPTION

From experience obtained from ethanol cooking projects being implemented in neighboring countries, two critical success factors are the price of the ethanol stoves relative to other cookstoves and the cost of the fuel.

2.2.1 STOVE COST RELATED ANALYSIS

Single- and double-burner ethanol cookstoves retail for sale in Malawi for an estimated \$41 and \$75, respectively. These estimated prices are based on a small-scale (approximately 1,000) tender price for the CLEANCOOK Comet-1 and Comet-2 stoves from South Africa and include costs for transport, excise, and VAT. These same stoves are being sold to customers in Dar es Salaam for a significantly lower price of \$14 and \$30, respectively, taking advantage of a larger tender of 110,000 stoves, and a subsidy from UNIDO of \$10 per stove (conversation with Harry Stokes of Project Gaia). Currently KOKO Networks (“Buy KOKO Cooker,” 2021) in Nairobi are selling a double-plate at a price of \$41, also including bulk buying discounts and a partial subsidy.

Experience from established ethanol cooking programs in neighboring countries shows that the upfront cost of the stove is a major barrier to adoption. From experiences in Dar es Salaam and Nairobi, an ethanol single-plate stove needs to be around \$20 to enable customers to purchase them readily and switch to ethanol cooking. Funding to buy down the cost of stoves could come from carbon offsets, donor subsidies, or a business investment with the payback collected from the margin in fuel sales. In Nairobi, KOKO is self-financing a discount on their stoves; in Dar es Salaam, UNIDO is utilizing GEF and European Union financing to subsidize the stoves; and in Madagascar and Kenya, Green Development is significantly subsidizing their single-plate stoves through carbon revenue.

Micro-credit is an option to assist customers overcome barriers to afford the upfront cost of stoves. Key microfinance institutions (MFI), with a high percentage of their customers in urban areas, include: Opportunity Bank of Malawi, FINCA Malawi Ltd, NBS Bank Limited (Small-Medium Enterprise Department), Finance Trust for the Self Employed, the Center for Community Organization and Development, CUMO Microfinance Ltd., and Finance Savings and Credit Cooperative (Transparency Pricing Initiative in Malawi, 2013; USAID and UKaid, 2020c).

2.2.2 FUEL COST RELATED ANALYSIS

Comparison of ethanol cooking costs at current levels of fuel usage requires an estimate of ethanol sales prices. Market information from other ethanol suppliers (KOKO Networks in Nairobi and Consumer’s Choice Limited Dar es Salaam) indicates fuel sales prices of \$0.70 to 0.87/liter including VAT. Table 4 shows a build-up of the sales price of \$0.87/liter for ethanol to the consumer starting from a distiller/producer factory gate price (currently at \$0.48/liter) in the case of Consumer’s Choice, after adding VAT, bottling, delivery, distributor and retailer margins, and administrative costs. Based on this example, the study team concludes that a mark-up of around \$0.40/liter might be needed to cover bottling, distribution, and sales margins for a distributor in Malawi. While the team anticipates that ethanol cooking fuel can receive a VAT waiver as is currently available for LPG in Malawi, the margin for the distributor and retailers will be expected to be higher than listed in Table 4 below, given the more expensive factory gate price for ethanol.

TABLE 4: BUILD-UP OF ETHANOL PRICE TO CONSUMER

COST CENTER	COST PER LITER (US DOLLARS)
Rectified ethanol from distillery	0.48
VAT payment	0.03
Bottles, labels, crates	0.10
Delivery to distributor or sales point	0.03
Distributor’s margin	0.04
Retailer’s margin	0.09
Administrative costs	0.02
Subtotal	0.79
Company’s margin	0.08
Cost to consumer	0.87

Source: *Consumer’s Choice, Dar es Salaam*

From a Malawi perspective, a significantly higher distiller price is estimated, given that PressCane and EthCo are selling blending alcohol at a gate price of \$1.00/liter and are still not able to supply this demand, due to a shortage of molasses feedstock. EthCo is reportedly producing around 12,000 liters of 95 percent technical alcohol a day that they are further processing to manufacture 99 percent blending alcohol. Given that EthCo loses at least 4 percent of their alcohol volume in this conversion and incur energy expenditure and processing costs involved in filtration to produce the higher concentration anhydrous alcohol, the study team estimates that EthCo might be convinced to sell a portion of their technical alcohol for the cooking sector at around \$0.85 per liter without losing money. Adding \$0.40/liter, the retail price of cooking ethanol would come to \$1.25 per liter, excluding VAT.

Using this as an indicative price, the study team compared the price of ethanol fuel compared to other fuels in the market in Malawi. The retail price could be lower if ethanol could be imported from the global market into Malawi, as explained in Section 1.4. On the other hand, the retail price could increase if the new MERA pricing regulations raise the price of fuel ethanol. The study team

thus extended the analysis by including +/- 15 percent to the retail price to get a high and low range of \$1.44/liter and \$1.06/liter.

Following this, the study team compared the cost per theoretical energy content in megajoule (MJ) by fuel and then adjusted for typical “in the pot” thermal transfer efficiencies. Results are shown in Table 5. The costs for cooking with charcoal are listed in the same row for both an efficient stove and the conventional Jiko stove, using average prices for dust removed charcoal in Lilongwe and Blantyre respectively.

TABLE 5: FUEL PRICE PER MJ

FUEL	PRICE PER UNIT	THEORETICAL PRICE MWK/MJ	IN THE POT PRICE MWK/MJ
LPG MERA	1,880 MWK/kg 2.47 \$/kg	40.87	68.12
LPG 6kg Afrox	1,880 MWK/kg 2.47 \$/kg	40.87	68.12
Average net charcoal price in Lilongwe	218 MWK/kg 0.29 \$/kg	7.73 11.60	25.77 38.66
Average net charcoal price in Blantyre	178 MWK/kg 0.23 \$/kg	6.31 9.47	21.00 31.50
Bioethanol – High, excluding VAT	1,094 MWK/lt 1.44 \$/lt	47.98	79.97
Bioethanol – Med, excluding VAT	950 MWK/lt 1.25 \$/lt	41.67	69.44
Bioethanol – Low, excluding VAT	798 MWK/lt 1.06 \$/lt	35.00	58.33
Electricity – T1 Schedule, with VAT	92.4 MWK/kWh 0.12 \$/kWh	25.67	36.67

Assumptions on net calorific value of each fuel and the burn or transfer efficiency by technology utilized in these calculations, shown in Table 6 below, have been extracted by comparing two sources (USAID and UKaid, 2020c; Doggart et al., 2020):

TABLE 6: FUEL NET CALORIC VALUE AND EFFICIENCY

FUEL TYPE	NET CALORIC VALUE	BURN/TRANSFER EFFICIENCY
LPG and Stove	46.0 MJ/kg	60%
Charcoal and Efficient Stove	28.2 MJ/kg	30%
Charcoal and Jiko Stove	28.2 MJ/kg	20%
Bioethanol and Stove	22.8 MJ/lt	60%
Electricity	3.6 MJ/kWh	70%

Even a cursory look at the relative cooking costs once the burning efficiencies are included shows that the cost to cook on a charcoal stove is well below half that of LPG and ethanol-based cooking. This “low” price of charcoal was further confirmed by comparing the average Lilongwe price of

\$0.29/kg with the current prices in Dar es Salaam of \$0.60/kg. Electric cooking is also low priced, but lack of reliability of power supply hampers its growth.

A mid-point price for ethanol of \$1.25 per liter, which is only 1 percent higher than the effective cost of LPG cooking when the MWK/MJ price between the two fuels is compared. Any ethanol distributor wanting to enter the market might be able to compete with LPG fairly well on cost and the advantage of small fuel sales quantities. That said, competing with charcoal will be more difficult until the price of charcoal rises a further 2 or 3 times. The selling point for bioethanol is that it may be able to deliver similar clean cooking and environmental benefits as LPG and has the advantage of lower upfront costs to the user and allows smaller purchase sizes. However, ethanol has a major disadvantage in entering the market when not known as a cooking fuel. For ethanol to be accepted as a credible cooking fuel in Malawi, it will first need to be introduced as a pilot with a clear objective of increasing awareness and acceptability.

2.3 POTENTIAL MARKET SIZE FOR ETHANOL COOKING IN MALAWI

In Malawi approximately 640,000 households are classified as urban. The four largest cities account for 497,000 of these urban households: Lilongwe (population 230,266), Blantyre (population 191,681), Mzuzu (population 49,565), and Zomba (population 24,993). The MCHF *Market Information Package for Clean Cooking for Urban Malawi* report (USAID and UKaid, 2020c) estimates that 195,498 households have the means to purchase and adopt an efficient/ultra-efficient charcoal stove; another 64,514 households have the means to purchase and adopt LPG, including a cylinder and equipment. Ethanol cooking will be expected to compete to supply a similar demographic as LPG during the commercial pilot given the comparable effective price of fuel between the two cooking options. If the price of ethanol goes down (either through imports or increase in supply of lower-cost feedstock within Malawi) and stove prices can be decreased using carbon revenue, the market for ethanol-based cooking could reach into the pool of households that are thought to have the means to purchase charcoal stoves only.

3.0 DISTRIBUTION BUSINESS CONSIDERATIONS

This section of the report discusses what a commercial ethanol-based cooking pilot supplying approximately 5,000 households would need to consider in terms of establishing a distribution business.

3.1 DISTRIBUTION OF STOVES

3.1.1 PRIVATE SECTOR OPPORTUNITY

Currently there is no supplier of ethanol stoves in Malawi; any potential distributor must include plans on how to source and make stoves available for their target market. Distributors will need to address the dynamics of stove supply and purchase by the target households. The mechanism supporting the sale of a stove must be planned (e.g., importation and resale by the distributor or a third party, considering the relative cost of ethanol appliances versus other stoves). The analysis in Section 2.2 will assist in this evaluation.

Unless this transaction is well managed and a good offer, possibly with some form of subsidy, rapid sales rates will be unlikely. The distributor might consider subsidizing the stoves from a development grant or as a business investment with a plan to recover costs through a margin in fuel sales. Given that ethanol is a renewable fuel with substantial greenhouse gas (GHG) reduction benefits, subsidies can come from carbon credits. However, since payments only come after the abatement is verified, the credits will likely be able to support subsidies in later years of the pilot or in a subsequent phase of the business. Given the relatively small size of the pilot, the startup distributor will most likely want to join an existing PoA, if available, to save both time and the cost of registering a new PoA. It will be important to ensure that the PoA is registered with the Gold Standard, or similar voluntary GHG registry, to be able to sell ERs into the voluntary market, given the current uncertainty regarding the future of the CDM.⁸

Stove retailing is a one-off activity, as opposed to ongoing fuel sales, that is suited to new product marketing companies and could well be outsourced by fuel distributors. Alternatively, any potential distributors need to have marketing/sales experience and skills to achieve the required rate of sales demanded by their business model.

Partnering with MFIs to finance stoves could also be an effective solution for the distributor to increase the speed of stove sales and market uptake. However, given the small size of these transactions, some form of bundling with other products may be needed to make the size of the loan large enough to be of interest to the MFI. Some of the larger MFIs with a higher percentage of urban clients (Opportunity Bank of Malawi, 40–60 percent; FINCA Malawi, 20–40 percent; Finance Trust for the Self Employed, 20–40 percent) (USAID, 2018) could in principle find it interesting to include ethanol stoves as part of their loan portfolio and provide loans for the purchase of ethanol stoves.

⁸ The uncertainty in the future of the CDM following the end of the second commitment period of the Kyoto Protocol at the end of 2020 means there is currently no clear market for CERs (Chagas, Greiner, and Hunzai, 2017). The voluntary market for verified emission reductions remains a viable option to promote clean cooking. PoAs registered under the CDM can transition to the Gold Standard or similar voluntary carbon registries. See the response to the question “How can CDM projects transition to the Gold Standard?” <https://www.goldstandard.org/resources/faqs>

3.1.2 STOVE TYPE

Selection of the stove type is important for success. Ethanol stoves must be rated ISO Tier 4 clean-burning stoves and above. Such stoves need to have been tested in accordance with the ISO 19867-1:2018 standard that covers particulate and gaseous air pollutant emissions, energy efficiency, safety, and durability. Stoves must be rated with firepower rating of at least 1.2–1.4kW power input and efficiencies of over 60 percent to achieve a reasonable speed of cooking. Stoves from Blue Flame and CLEANCOOK, currently showing good results in programs in Kenya and Tanzania, have ratings of 1.55 kW and 1.8 kW, respectively.

3.1.3 STOVE DEVELOPMENT AND MANUFACTURE

Given the number of very high-quality ethanol stoves in the global market, developing a new stove for the Malawi market may not prove to be a worthwhile effort. Designing and testing a new stove requires significant research, development, and ISO testing, and lends itself to organizations that specialize in appliance manufacture. Hence, it is highly likely that the stove will need to be imported with possible local assembly. There is a competitive international market with several designs of high-efficiency ethanol stoves that could satisfy the requirements of the Malawi Bureau of Standards. Floating a tender for several thousand stoves at a time is likely to attract offers of lower prices and options for local assembly from kits.

3.2 DISTRIBUTION CHANNELS FOR ETHANOL FUEL

3.2.1 FUEL SUPPLY, STORAGE, AND GATE PRICE

The best option for sourcing small volumes of cooking ethanol to launch a pilot is to reach an agreement with EthCo to access a portion of the 12,000 liters per day of technical ethanol they currently produce. Sourcing ethanol domestically avoids the risk of signing long-term contracts for imports when the market is only just being developed. If sales of 5,000 stoves can be reached by the end of the pilot's second year, at an average consumption of 6 liters/month/stove, the 30,000 liters per month could be provided relatively easily by EthCo as long as the distributor is able to offer them a competitive price. Given the gate price of around \$1.00 per liter for blending ethanol in Malawi, the study team estimates that the price of unrefined technical ethanol might be around \$0.85 per liter.

Delivery scheduling and storage is imperative, given the negative consequences of intermittency in fuel supply to these new customers. A good guideline is for three months' strategic stock to be held in tanks, bottles on site, or bottles at retail agents. This will ensure that there are no shortages and a well-supplied market.

3.2.2 FUEL COMPETITIVE PRICE POSITION

The relative price of ethanol in comparison to other fuels in the Malawi market will be central to uptake of ethanol cooking. Based on experience from East Africa, a gate price of \$0.85 for relatively clean technical alcohol should translate to a retail price of around \$1.25 per liter. As described in Section 2 of the report, ethanol even at this price could still be competitive with the price of LPG. However, it will be important to find ways to reduce this price through importing ethanol or finding other sources domestically to avoid these high fuel prices slowing down the uptake of clean fuels, given the low price of illegal charcoal on Malawi.

The marketing approach should demonstrate a balanced approach between managing the negative impacts of high fuel price along with stressing other positive attributes of the technology such as the smaller scale purchase volume than LPG, that it allows for in-house cooking, and the rapid ignition and ease of cooking compared to charcoal. Focusing only on fuel cost comparisons and neglecting to highlight the other advantages in marketing risks limiting the market uptake.

3.2.3 FUEL PREPARATION/HANDLING

Investment in storage, strategic stocks, and bottling plants is needed. This includes fuel truck off-loading infrastructure, a fuel quality testing laboratory, batch mixing to the correct specifications and denaturing, and a bottling line that will handle the expected sales volumes. This task could also be delegated to an independent bottler on behalf of the distributor. Specifications and supply sources for ethanol bottles include bottle plastic, wall thickness, returnable versus disposable, labeling, and crating.

The matter of safety and correct handling procedures for ethanol requires competency in handling of a flammable fuel, as well as knowledge of flameproof motors on pumps. Fuel denaturing is required and the distributor should be knowledgeable about quantities of chemicals that will need to be added and the colors that will be used.

3.2.4 FUEL DISTRIBUTION/MARKETING

Given that a new fuel must be made available for purchase by households, a range of transactions—ranging from wholesaling through to final sales points for the bottles—will need to be managed properly. This could be in the form of a new dedicated ethanol cooking fuel business that markets, delivers, and sells to the households; alternatively, the bottles can be supplied via existing retailers.

3.3 CAPITAL AND SKILLS NEEDED

3.3.1 INVESTMENT AND WORKING CAPITAL

Substantial capital would be needed if the distributor should propose to retain the procurement and supply of stoves as part of their market offering. To obtain good prices and volume discounts, a full order would be recommended for a pilot of approximately 5,000 stoves. For just single-plate stoves, the contract value with a stove supplier will be worth around \$140,000. Double-plate stoves are available at nearly twice the price.

At least three months' strategic fuel stocks must be maintained, in case of shortages, either in bottles or storage tanks. For a 5,000-household fuel supply business, this translates into 90,000 liters of fuel, or \$76,500 at a purchase price of \$0.85/liter. Hence, the working capital needs of a distribution business cannot be underestimated. The specialized needs of handling fuel require significant investment capital in plant and infrastructure. All these investment costs will need to be reflected in the business plan and weighed against the expected margin of each liter of ethanol sold.

3.3.2 DISTRIBUTION BUSINESS CORE COMPETENCIES

Being a consumer goods business, the distributor needs to have experience in distributing and selling of consumables at the household level. Attributes would include brand building, customer loyalty, competitive market offers, promotional methods, and sales. Knowledge of the safe use of ethanol as a cooking fuel is another requirement. This starts at the bulk fuel handling level and includes the

storage/bottling plants where standard industry safety procedures must be strictly followed. It extends to usage/safety training that will be provided to households at the point of stove purchase.

3.4 SOURCES OF FUNDING/FINANCING THAT CAN JUMP-START INVESTMENT

Startup distributors can apply to a range of international grant and credit funds for investment to expand ethanol cooking in Malawi. These grant and credit funds include the following:

- [Energy and Environment Partnership South and East Africa \(EEP Africa\)](#) provides early-stage grant and catalytic financing to innovative clean energy projects, technologies, and business models in 15 countries across Southern and East Africa. EEP has put out 16 open calls for proposals since 2010, with awards ranging from 0.2M to 1.0M Euros (EUR). There is a minimum co-financing requirement from the applicant of 30 percent. Private companies, non-profit organizations, and social enterprises are eligible to apply. Eligible project types include feasibility studies or pilots, demonstrations, replications, or scale-up. Technologies include liquid biofuels, biogas, cookstoves, solar, wind, and hydro. Ethanol projects for cooking and power generation have successful recipients of awards in the past.
- [Nordic Climate Facility](#) is a challenge fund that provides grants ranging from EUR 0.25M to 0.5M to innovative climate change projects in developing countries. Grants can be used to test viability of business concepts. There is a requirement to have a Nordic partner in the venture. Calls have been announced annually since 2009; however, there is not currently an open call at present.
- [Renewable Energy Performance Platform \(REPP\)](#) is an innovative funding platform created by the European Investment Bank and the United Nations Environment Programme, and funded by the UK Department of Business, Energy and Industrial Strategy. REPP provides early-stage funding and results-based finance for small- and medium-scale renewable energy projects in Sub-Saharan Africa. The results-based finance can be structured as reimbursable grants or concessional loans. Investments typically range between US \$0.2M to 5M. Biomass and biogas projects are eligible, as are solar, wind, hydro, and geothermal projects.
- [USAID's Development Innovation Ventures \(DIV\)](#) provides grants for testing and scaling innovative business models. DIV provides grants in three stages: a) Proof of Concept (up to \$200,000; Testing and Positioning for Scale (up to \$1.5 million); and Scaling (up to \$5 million).

3.5 MINIMUM SCALE NEEDED FOR A VIABLE ENTERPRISE

Should the 5,000-household pilot be successful and demonstrate growing demand for ethanol-based cooking, it is useful to plan what a profitable enterprise for supplying the sector might look like. For the distribution part of the supply chain, the economics are all about the scale of operation. Scale will rely on rapid uptake/delivery of stoves to create a critical market size quickly, handle bulk/large purchase contracts for stove and fuel to negotiate the greatest discounts, and allow for sufficient planning and execution of targeted selling into the most attractive market areas with the highest-expected penetration density to lower last-mile distribution costs.

Experience from other countries in Sub-Saharan Africa (inputs from Project Gaia) indicates that a market of approximately 20,000 households would provide a business with long-term commercial viability that the distributor could supply fuel for without having to charge a prohibitively high margin. The scope of that market might look as follows:

- Households that purchase an ethanol stove will start with using an average of 6 liters/month (limited to preparing beverages and other quick-cooking needs) under a stove stacking scenario, and increase demand to 30 liters/month if a full shift from charcoal-based cooking to ethanol is achieved. Even assuming the retail price for ethanol comes down to the low range of \$1.06 per liter, averages of no higher than 10 liters/month should be assumed by the prospective distributors in estimating revenue.
- A market of 20,000 stoves would represent a minimum of 200,000 liters of ethanol per month or 2.4 million liters per year. If sourced domestically, such a volume of demand would use up most of the supply of technical ethanol currently produced by EthCo. In the event that domestic production of ethanol will not have expanded by this time, 2.4 million liters is a large enough demand to source ethanol from the global market.
- Margin on the fuel sales is unlikely to be above 10–15 percent, or \$0.11–\$0.16/liter once the costs of transportation, stock holding, bottling, and final retail commission are taken into account. These margins will need to pay for all the infrastructure and market investments and provide a return to the distributor.

BOX 1: ETHANOL COOKING PILOT

A commercial ethanol cooking pilot selling stoves and supplying fuel to around 5,000 households over two to three years could be used to increase awareness about its benefits and test the attractiveness of ethanol as a domestic cooking fuel. Stoves would initially be marketed to upper- and middle-class households in Lilongwe and Blantyre and would expand gradually to the other residents of these cities. The pilot would require an estimated investment of around \$600,000 from an impact investor. This investment could be de-risked by a grant of \$250,000, such as is competitively available through the Malawi Clean Cooking Fund or from one of the other funds listed in Section 3.4. If ethanol prices can be brought down to the levels available in Kenya or Tanzania, whether through imports or after resolving the feedstock bottleneck in Malawi, ethanol would be a less-expensive fuel than LPG. In this situation, the market for ethanol-based cooking could be expanded to reach lower-income households, particularly if charcoal prices have also risen by that time.

4.0 MALAWIAN GOVERNMENT ACTIONS TO SUPPORT ETHANOL COOKING

Despite the unresolved challenges of sourcing ethanol fuel at an affordable price, there are several justifications for the Government of Malawi to support and encourage private distributors to introduce ethanol cooking in Malawi at this time.

4.1 REASONS FOR THE GOVERNMENT TO SUPPORT ETHANOL-BASED COOKING

Recent experiences from neighboring and other Sub-Saharan countries show that the ethanol stove technology and business models for distributing ethanol fuel have matured to meet the cooking needs of urban consumers fully. At least two initiatives in East Africa—KOKO Networks in Kenya and Green Development in Kenya and Madagascar—have sold over 50,000 high-quality ethanol stoves each and are supplying customer households with ethanol fuel on a regular basis. UNIDO has launched an ambitious program in Tanzania to try to scale up ethanol-based cooking to 500,000 households.

Unlike many of its neighbors, Malawi already has a well-developed distillation and refining capacity in place to expand production of ethanol rapidly once the feedstock bottleneck is overcome. The recent adoption of cost-plus regulations around pricing of ethanol fuel could potentially encourage the distilleries to expand their processing capacity and invest into growing more feedstock. Producing the ethanol fuel needed for cooking in-country would reduce volatility in future fuel prices that customers risk facing from petroleum-based imported cooking fuels.

Once established, ethanol cooking can be scaled up relatively inexpensively, as the investment into infrastructure to store and distribute fuel is favorable compared to that needed for competing modern cooking fuels such as LPG. Dalberg (2018) finds that capital expenditure requirements for scaling LPG in Kenya is 18 times that of bio-ethanol following KOKO Network's V2.0 model. They calculate investment of \$290 million in investment required for LPG versus \$16 million for ethanol when they compare incremental capital investment required to extend supply to 2 million additional households in urban Kenya for LPG versus bio-ethanol. The largest single infrastructure investment category for LPG is last-mile distribution including cylinders and trucks (57 percent), followed by bulk storage and transport, which includes tankers, depots, and filling plants (34 percent), and capacity increase of the terminal at the port where LPG is received from ships (9 percent). For ethanol, the majority of the costs are in micro-tankers needed to support last-mile distribution. Bulk storage and transport and terminal costs are relatively small for bio-ethanol. An analysis for Malawi is likely to come to a similar conclusion, given that the last-mile distribution costs for LPG will likely be proportionally similar in both countries. Last-mile costs for bio-ethanol could be somewhat higher in Malawi if the V2.0 model of using micro-tankers to supply fuel ATMs is not followed and investment into retail infrastructure could be higher.

Charcoal prices will continue to increase as raw materials become more scarce, distance from production centers increases, and the GoM introduces tighter regulations around charcoal manufacture and trading. This is beneficial to ethanol fuel distributors, as their potential market will continue to grow in the years ahead; getting in early allows for brand development and experimental business learning, and positions them for future expansion.

4.2 REGULATIONS AND POLICY SUPPORT NEEDED FOR INTRODUCTION OF ETHANOL-BASED COOKING

Regulations and policy support that could support the introduction of ethanol-based cooking are set out below:

1. Ethanol as a denatured cooking fuel requires a separate classification and treatment by the Department of Energy Affairs, MERA, and the Bureau of Standards. This is similar to the way blending fuel is treated, but different from ENA for the beverage industry.
2. MERA could require EthCo and PressCane to supply a percentage of their production of annual rectified and technical ethanol production for cooking fuel at a gate price that is below (e.g., 75 percent) that of anhydrous alcohol.
3. Cooking fuel will require different pricing regulations from the blending ethanol pricing structure. There would be a need for maximum price regulation similar to LPG to protect consumers from price gouging. Distributors will need to be required to hold three months' worth of strategic stocks.
4. The Department of Energy Affairs will need to adopt and implement an ethanol fuel supply management framework to ensure continuity of supply. Such a framework would cover tracking local ethanol production and recommend issuance of importation licenses as needed as well as a waiver on imported ethanol.
5. Given the market growth is constrained by the ability of households to purchase ethanol stoves, the VAT on stoves would need to be waived at the same time that it is removed for LPG and improved cookstoves.
6. To ensure parity with LPG in the market, VAT on the sale of ethanol for specific use as a cooking fuel needs to be waived and differentiated from ENA where VAT is levied.
7. New ethanol cookstove and cooking fuel standards will need to be adopted through the National Cookstove Steering Committee and by the Bureau of Standards, plus mechanisms for stove and fuel testing.

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APPENDIX 3: MEETING NOTES

LLOYD ARCHER – UNITED PURPOSE

Interview held on 10 November 2020 from 16:00 until 17:00

Background⁹

United Purpose has been operating in Malawi since 1988, initially to support refugees from the Mozambican civil war and their hosts in the Dedza area. Today, we are one of Malawi's largest NGOs, working in partnership with local government and communities across fourteen districts mainly in central and southern Malawi. During this time, they have developed a trusted reputation with most of the established institutional and non-institutional donors and organizations in the country.

Lloyd is responsible for the establishment and growth of the sustainable energy unit in United Purpose Malawi. Focused on increasing access to energy for poor/marginalized communities, enhancing energy markets and establishing innovative financing.

General Information

- Strong role has been played by Lloyd within the wider “national cook stove steering committee” of Malawi.
- Significantly raised the profile of clean cooking in Malawi
- Significant focus of United Purpose and others thus far has been the supply of efficient wood stoves; such as the locally produced efficient Chitetezo Mbaula stoves. Number supplied is around 2 million in the past 5 years. The approach has been to allow “neighbor” influence and through acceptability and local demonstration.
- However, most of the emphasis has been on rural areas, with attention now turning to urban areas to combat charcoal usage. Malawi used to have a significant number of urban firewood users. In recent years both wood and electric cooking has declined in favor of charcoal.
- Ongoing rural program is based on cash sales of stoves, since the price of the Chitetezo, at \$2, is too small to justify the transaction cost of introducing credit sales. A programme shift to an urban market with more expensive stoves might open opportunities for credit.
- Minimal penetration of LPG is recognized, with perhaps 50,000 households use.

United Purpose Ethanol Focus

- Focus is on small ethanol briquettes, rather than liquid fuel ethanol. This is linked to a technology agreement with a British company BCB.
- These sealed briquettes will be used in a stove similar to a Chitetezo Mbaula, using a ceramic insert, with the ethanol briquette just replacing the charcoal. The advantage would be the

⁹ <https://united-purpose.org/malawi>

avoidance of investment in an expensive liquid burning stove. One disadvantage would be inability to turn off remaining fuel after cooking is complete, as can be done with a liquid ethanol burning stove.

- Tests will begin shortly on a small scale 50-stove pilot to evaluate acceptance and costs.

Documents (To Be Reviewed)

- Following the meeting the following documents were shared:
 - Refugee fire Dragon presentation from BCB.
 - Brief report on ethanol briquette usage tests.
 - Market assessment for modern energy cooking services in Malawi, a working paper version dated September 2020. (MECS/University of Strathclyde).
 - Market Entry Information Pack, Southern Africa Energy Program (SAEP), Power Africa.
 - Notes on charcoal trends in Malawi.

LUIS FERNANDES – ILLOVO SUGAR

Interview – completed via a set of emails.

Background

Illovo Sugar (Malawi) Ltd in Malawi's has agricultural and milling assets at the Nchalo Sugar Estate located 80kms south of Blantyre in the southeast of the country and at the Dwangwa Sugar Estate located 306kms north of Lilongwe on the Northern Lake shore in the mid-central region.

Luis Fernandes is based in South Africa as the Export Manager – Downstream, has responsible for the sale of molasses and ethanol in Illovo mills.

General Information Provided

- Both sugar mills produce molasses and all the molasses is sold on to the two Malawian distillers EthCo / PressCane. As all is utilized in country no molasses is exported. Illovo cannot supply enough molasses for the two distilleries so they both run at about 60 percent capacity.
- Illovo are running at full capacity in both sugar mills, produce about 90,000 tons/annum of molasses which is all fully utilized by the two distilleries.
- Currently Illovo have no upgrade plans for their plant in Malawi.

SUSAN FLYNN – FOUNDER OF CHANASA IN MALAWI

Interview held on 11 November 2020 from 16:00 until 17:00

Background

Susan Flynn is the founder of Chanasa in Malawi (established in 2014). She spent 20 years in Social Services, followed by 17 years in the ministry of the United Reformed Church. In her leisure time Susan studied and made creative stained glass for 9 years but since retirement in 2011 she has studied Fashion and become very interested in Sustainable Fashion. Susan has experience of setting up three voluntary organizations in the UK, two of which are church and community enterprises. She has been coming to Malawi since 2005 through a Synod Global Partnership and has organized visits in both directions. Her focus is on supporting the work of women in the Churches of Christ in Malawi. Her work for Chanasa as an independent charity has grown out of this involvement. Chanasa began in autumn 2012 and was registered as a charity in April 2014. Susan now makes twice yearly visits for 3 weeks at a time to help develop Chanasa.

Historical Involvement in Ethanol Cooking

- Susan has been convinced for many years that ethanol would be a good alternative for charcoal cooking in urban settings. Has followed a go it alone route with local organizations, whilst gathering information from the likes of KOKO Networks, Project Gaia.
- Blustove device was developed by Mr Gaffar Jakhura (RAB Food Processing Group and Gift of the Givers Foundation) who unfortunately died at the end of this June. He had wanted the Blustove to be evaluated by the Strathclyde University team. Checked with the Jakhura family and whilst they are all involved in business, there is no-one in the present economic climate who is able to commit to the development of the Blustove. It needs someone to take it on and invest in it if Malawi is to have its own stove. It seems likely that Mr Riaz Jakhura would agree to this happening. Susan can provide the contact for Mr. Riaz.
- Overall, the discussion focused on her work and then inputs on how ethanol can become a viable option.
- When questioned, Susan herself and Chanasa as an organization will not become actively involved in the distribution of stoves and fuel.

General Information Provided

- Extensive range of emails and documents were provided on her work and allied information. This will be reviewed by the team and included in the work where applicable.
- Specific documents shared:
 - The Bioethanol Industry in Sub-Saharan Africa: History, Challenges, and Prospects
 - Feasibility study for the use of ethanol as a household cooking fuel in Malawi
 - Bluwave Technology Notes, 2020; Susan Flynn.
 - Bluwave Ethanol Stove Assessment, 2006; James Robinson.

Potential Distributor

- During the discussion it was established that RAB food Processing company would be a good fit as a distributor and will be engaged as part of the process. They operate a set of stores called Kulima Gold. They have a factory which bottles Thumbs Up and Water.

JOSEPH KALOWEKAMO – ACTING DIRECTOR, DEPARTMENT OF ENERGY AFFAIRS

Interview held on 10 November 2020 from 15:00 until 16:00

Background

- Ethanol gel was tried as a cooking fuel in 2005 but did not catch on. Paul explained it was probably because of the slow speed of cooking as a result of low heat output of gel fuel given its low surface area. A detailed overview of ethanol fuel-based cooking provided to ensure a good background understanding/appreciation by the department.

Ethanol Fuel Supply

- Distillers are producing at half capacity and claim there is not a paying market for the fuel. Sugar production in Malawi is seasonal and that might also be responsible for the below capacity production during the off season, plus a shortage of molasses.
- Joseph can give us the contact for the CEO of EthCo. The other distiller is PressCane.
- In addition to Illovo, there is a new sugar producer in Malawi called Malawi Sugar Company which could also be interested in supplying the raw materials for ethanol production.

Regulatory Issues

- Price of ethanol is currently pegged to price of gasoline, which is currently selling at MWK 694 per liter. However, the exact numbers are handled by MERA.
- Since denatured cooking ethanol can be made easy to distinguish from drinking alcohol or blending alcohol, the regulatory agency MERA could delink the price of cooking ethanol from petroleum prices.
- The Bureau of Standards will need to set/adopt standards for cooking ethanol fuel.
- VAT and excise duty currently removed from LPG, although LPG is subject to a separate levy.

Energy Policies

- Ministry of Energy is the custodian of energy laws. Regulator MERA is responsible for setting prices. Incentives to promote specific fuels must be proposed by the Ministry of Energy to be approved by the Ministry of Finance.
- NGOs asked for VAT removal from clean cooking stoves and fuels. Joseph put together the proposal for removing VAT from LPG stoves and fuel and clean biomass cook stoves. Ethanol stoves and fuel can be added to the list of VAT exempt fuel and proposed to Ministry of Finance.
- Joseph can share with us the National Energy Strategy and the Action Agenda for Malawi.

Agreed Additional Information that Would be Supplied By Mr. Kalowekamo

- Contact for the CEO's of EthCo and PressCane, the local distillers
- Contacts for the new Malawi Sugar Company
- Copy of the National Energy Strategy document
- Action Agenda for Malawi.

MWAGA MKANDAWIRE – SENIOR GAS REGULATION SPECIALIST/HEAD OF UNIT FOR LPG AND LIQUID FUELS, MALAWI ENERGY REGULATORY AUTHORITY

Interview held on 11 November 2020 from 15:00 until 16:00

Mera's Regulatory Scope

- MERA regulates petroleum, LPG, and other commercial fuels sold in Malawi from both a price and quality perspective. Price is regulated naming a maximum retail price to avoid gouging of customers. Distribution licenses are needed to sell fuels of any type across the supply chain at wholesale and retail levels.
- MERA currently regulates fuel usage of ethanol. This is currently limited to ethanol used for blending with gasoline.
- If there were to be a market for ethanol as a cooking fuel, MERA's regulatory authority would extend to it. Similar to LPG, MERA would look at introducing a maximum regulated price for ethanol cooking fuel calculated using a cost-plus methodology, which would include a commercial margin. This in turn is to protect the consumer from price gauging.
- Extra neutral ethanol (ENA) is regulated for quality by the Bureau of Standards for quality. There is no price regulation as the application is alcoholic beverages.

Regulations for Ethanol Blending

- The price of blending ethanol used to be linked with global petroleum prices, plus an offset. When global petroleum prices were high distilleries sometimes had a margin of over 100 percent in some years. In recent years, they have lost money due to the linking of prices with petroleum and this has deterred production of ethanol and plant investment. Total volume of gasoline used in the country is around 550,000 liters/day. While the mandate is to blend to an E20 standard, in practice actual blending is currently between 8-10 percent.
- New pricing structure is now in place to increase profitability for distilleries in order to keep up with production. One important question is if the market for ethanol will be opened to imports. Currently molasses can be imported into the country. The new basis for the price of ethanol would be cost of production, plus allowable mark-ups for future investments. Mwaga can link us with economic specialists within MERA who are familiar with these calculations.

Incentives for Cooking Ethanol and Clean Cooking Fuels

- MERA supports implementation of Malawi's national energy policy and works to move the country toward an energy secure, clean and forward-looking energy sector.

- Environment is high on the agenda for the President.
- VAT and customs duty have been removed for LPG fuel. VAT could also be removed for ethanol as a cooking fuel. A proposal would need to be sent from the Ministry of Energy to Treasury. VAT is currently 16.5 percent. There is a levy on LPG of 4.5 percent to raise money for rural electrification.
- LPG currently retails at \$2.30 per kg. It is high due to the monopoly of Afrox. Landed price is only \$0.60 per kg in say the Beira port. A new department (just 9 months old) has been opened at MERA to address LPG related questions and Mwaga was brought in to head it. He wants to bring in competition from other suppliers and increase penetration of LPG into the cooking market. Maximum retail price should be brought down but will take time.
- 6 kg is the standard LPG cylinder size. This is not as big a barrier since partial filling is allowed in Malawi. Mwaga wants to also allow cross-filling for ease of consumers.

INDUSTRIAL VISIT TO PRESSCANE – FIELD NOTES

Site visit on 20 November 2020. Accompanied by Hudson Kabanga, Process Manager at PressCane Limited; and Bryson Mkhomaanthu, Operations Manager at PressCane Limited

- PressCane is ISO certified company, established in 2004. PressCane is a subsidiary of Press Corporation, one of the largest conglomerates in Malawi.
- The plant is rated at 90,000 liters of industrial grade ethanol or rectified spirit (95-97 percent v/v) per day
- Production in 2018 was 16.7 million liters (from 65,951 tons of molasses) and in 2019 was 17.8 million liters (from 75,695 tons of molasses). On average, the yield is 245 liters of 95 percent ethanol per ton of molasses.
- Current production is 7,000 liters from which 6,000 of 99.5 percent fuel grade ethanol is produced
- Only two grades are produces:
 - 99.5 percent v/v for fuel blending
 - 95-97 percent v/v for industrial application
- Relative cost of production for the two grades: The refining of ethanol from industrial grade to fuel grade takes further refining under vacuum and through adhesion filtration process-considerably more expensive.
- The industrial grade ethanol is about 10,000 liters per day is available to wholesale buyers. This could be available as a cooking fuel. Currently, the demand for industrial grade ethanol is low.
- Fuel ethanol is sold to the petroleum industry for blending while the industrial grade is available to all whole customers.

- Fuel ethanol price is controlled by MERA and is at K810/ liter while industrial grade ethanol is at K1035/ liter. The challenge is that the moment part of the industrial grade is taken in as a cooking fuel, there is likelihood that MERA will come in to regulate it.
- Illovo supplies about 50 percent of the molasses at 75 US\$/ton, balance by suppliers from Mozambique and Zambia. The offer price of Illovo is twice what the other companies are offering. The relationship has not been that cordial. A contract has been signed this year- for the first time;
- PressCane imports molasses from Zambia (30 US\$/ton) and (35 US\$/ton) Mozambique. In addition, PressCane has developed a sugar plantation in collaboration with smallholder farmer's cooperatives to produce own sugar syrup in the future.
- Currently the cane is sold to Illovo because PressCane does not have a sugar mill yet.
- The company is currently constrained by the capacity of the boiler to enable the plant to attain the rated production capacity of 90,000 liters per day.
- In terms of future investments, the immediate project is to use the wastes from the refinery to produce biogas. This biogas will be used to sustain the power needs of the factory. It is projected that there will be excess biogas which could be cleaned and sold at a price lower than LPG as a cooking fuel.
- The grades of ethanol produced meet the Malawi Bureau of Standards requirements. If any blending is done with residues or other components, the product will be expected to meet the MBS specifications.
- Could you be interested to pack for distribution for mass market?

MAYA STEWART, DIRECTOR MAEVE PROJECT

Interview held on 5 November 2020 via WhatsApp

Background

Maya is a Director of MAEVE Project in Malawi, who focus on promoting biomass energy conservation, clean technologies and mitigating climate change applications, including; efficient wood mbaula, solar home technologies and rocket stoves. Of note, they have been in touch with other East African ethanol projects (KOKO Networks in Kenya and Consumer's Choice in Dar es Salaam).

Through her work she has an in-depth knowledge of cooking norms and realities in Malawi which were interrogated.

Plus, Maya Stewart and her associates are potential future ethanol distributors in Malawi and would be interested in applying for the expected USAID call for proposals.

General Malawi Household Cooking Information

- 90 percent of urban cooking is charcoal based, <2 percent LPG and rest electricity/wood.
- People fear LPG is dangerous and can explode in the home.

- Charcoal expenditure a day is around \$0.50/380MWK, covers over half of the days cooking needs.
- Charcoal costs – 20kg bag around \$20.00/15,100MWK.
- Electricity is used for simple cooking, frying eggs, boiling beverage water etc. with backup always needed due to outages. But limited to around 10 percent of urban households. Electric cooking is expensive since ESCOM electricity is most expensive in the region.
- Primary cooking needs are for beans & maize porridge, normally cooked over charcoal.
- Charcoal stove costs \$2.00/1,511MWK versus electric of over \$20.00/15,100MWK. Around 10,000 households (100,000 people) might have a \$20 electric cooker.
- Charcoal vendors are the source of purchases, but government restrictions are increasing due to deforestation. Charcoal vendors could be made distributors for ethanol, to avoid loss of livelihoods.
- Sustainable charcoal is marketed through high-end shops @US\$6/ 20 kg.

Inputs on Ethanol Based Cooking & Distribution

- Raising of capital via normal commercial banks is limited given the unknowns related to the business models
- Envisaged that micro loans will be needed by users to purchase ethanol stoves costing over\$20.00/15,100MWK.
- Stove ‘stacking’ and the retaining of an ethanol for only ‘light’ cooking needs and continued use of charcoal for the ‘heavy’ needs will need to be addressed if significant ethanol volumes are to be sold.
- Currently VAT (16.5 percent) is waived on LPG and efficient biomass cook stoves.
- Whilst methylated spirits is VAT free, cooking ethanol is currently not recognized and VAT exemption would be a problem.
- Excise duties on cooking ethanol also not known, but Maya will be engaging the Ministries this week.
- Not sure of local ethanol quantities available or government position re blending versus cooking ethanol

Market Matters

- High income - 10 percent of households >\$500/380,000MWK per month
- Middle income - 40 percent of households ~\$60-500/45,000- 378,000MWK per month
- Low income - 50 percent of households <\$60/45,000MWK per month

- There are 500,000 urban households in Malawi. Further analysis is needed to determine the size of the Malawi market for households cooking on ethanol.
- Behavior challenge is the biggest challenge. Markets will expand through word of mouth from satisfied users.

Markets for Similar Products

- Maeve currently markets the ceramic firewood burning Chitetezo Mbaula stove under a Results-based Financing (RBF) program funded by EnDev. The stoves are sold at \$2 each and RBF program provides signed vouchers for an additional incentive per stove with an objective of selling 80,000 stoves per month.
- RBF also extends to solar home systems and supports sales of 100,000 products per year. Maeve markets 18 different Lighting Africa certified products using Pay-as-you-go (PAYG) terms under [Yellow Africa](#).
- World Bank was to launch PAYG through the National Development Bank of Malawi for electric lighting products. Program has been delayed due to COVID.
- The Millennium Challenge Account had an off-grid program but has been phased out.

Ethanol Supply

- Distillers (EthCo and PressCane) have excess nameplate capacity and can make denatured alcohol if there is demand. They are working at 50-70 percent capacity at present.
- There is a big demand for alcohol at present for hand sanitizer.
- Maya can import alcohol from Tanzania if local suppliers can't meet demand. Transportation is a big challenge in Malawi. So local manufacture would be preferred.

MCHF Bid Participation

- Maya is planning to respond to the Clean Cooking Fund RFA which will be called this month.
- Her understanding is that the RFA will allow the same company can apply for more than 1 technology.

MRS LUSUBILO CHAKANIZA – CEO OF ETHCO

Meeting held on 27 November 2020 via Zoom.

Participants

MEETING PARTICIPANTS		
NAME	TITLE	ORGANIZATION
Ms. Lusubilo Chakaniza	Chief Executive Officer	Ethanol Company Limited
Kenneth J. Gondwe	Consultant	Winrock International

MEETING PARTICIPANTS

NAME	TITLE	ORGANIZATION
Paul Harris	Consultant	Winrock International

Background

The objective of the overall assignment was to provide a justification for ethanol to be considered as a viable cooking fuel for Malawian urban households to replace charcoal. Since ethanol was not part of the original list of options in the (MCHF) project, the team is putting together facts and figures to elaborate the potential of ethanol as a future cooking fuel for Malawi.

It was highlighted in the discussion that prior to 1994 (i.e. before multi-party democracy), there were very strict forest conservation laws and measures. Urban residents used paraffin as supplementary cooking fuel instead of charcoal. Post 1994 period saw lack of enforcement and rapid increase in the use of illegally produced charcoal which completely removed paraffin from cooking energy mix.

The team wanted to learn from ETHCO about their operations and their potential to produce ethanol that could be used as a cooking fuel.

Primary Message of Interview

- The installed capacity of ETHCO is 60,000 liters per day consisting of 48,000 liters of extra neutral alcohol (ENA) and 12,000 liters technical alcohol. All the technical grade alcohol is used as feedstock to produce fuel grade ethanol. The current capacity is 20,000 liters per day- the plant is run when enough technical grade alcohol has been produced. Annual production of fuel ethanol is about 3 to 3.5 million liters.
- The ENA is produced for both local and regional markets;
- Since mid-2020, MERA amended the regulation that pegged fuel ethanol price on world petroleum price. Now ethanol price is based on cost plus margin model. The new pricing model makes production of fuel ethanol viable. The mandatory requirement to blend at 20 percent provides a guaranteed market to the fuel ethanol producers. The gate price is about 1 US\$/ liter.
- On whether ETHCO would be interested to produce or import and sell ethanol for cooking, the response was straight forward. The company goes to business that gives it maximum returns. Future plans are to invest in the production of more fuel grade ethanol where both the price and demand are attractive. Current sales prices for ENA was confirmed at \$0.90 - 1.15/liter, when viewed in combination with the blending gate price, translate into a message that cooking fuel ethanol prices are seen as too low.
- The factory is run on seasonal basis in due to seasonal production of molasses by the sugar industry. This impacts on the price structure of its products which must offset the non-productive period;
- Although molasses is complemented with supplies from Salima Sugar Factory and Zambia, the feedstock is not enough to run the plant optimally. ETHCO is investing the production of its own feedstock (working with local sugarcane farmers) in order to meet its future needs;

- The company will invest in the milling plant by 2023 and expand fuel grade production plant by 2025-2030.
- The company has supported work in the area of cooking ethanol when approached by a local university (Malawi University of Science and Technology-MUST). MUST assessed the potential of cassava as alternative feedstock for small-scale production of fuel ethanol.
- ETHCO participated in the launch Zoom meeting of 1.1 million US \$ grant by MCHF project sponsored by USAID and UKAID.
- ETHCO did not rule out participating in the cooking fuel ethanol provided it makes a business sense.

MALAWI BUREAU OF STANDARDS

Meeting held 3 December 2020 via Zoom

Participants

MEETING PARTICIPANTS		
NAME	TITLE	ORGANIZATION
Fred Sikwese	Director of Standards Development	Malawi Bureau of Standards
Gunseyo Dzinjalama	Standards Manager	Malawi Bureau of Standards
Bikash Pandey	Director, Clean Energy	Winrock International
Kenneth Gondwe	Consultant	Winrock International
Paul Harris	Consultant	Winrock International

Background

The objective of the overall assignment was to provide background information to assess prospects for ethanol as a potential cooking fuel option for Malawi. A number of stakeholders have been consulted from the Government, the Regulator, the ethanol manufacturers, and others in the value chain. One of the outstanding pieces of information related to standards for both the fuel and end use devices (stoves).

The team wanted to learn from Malawi Bureau of Standards (MBS) about the following issues:

- Status of ethanol standards, especially ethanol to be used as a cooking fuel;
- Availability of standards for ethanol stoves; and
- The process for development of a new standard.

Primary Message of Interview

- MBS currently has four different standards of ethanol
 - 99 percent ethanol grade used for blending with gasoline (anhydrous alcohol);

- Food grade ethanol for spirits (extra neutral alcohol);
 - Analytical grade/ lab reagent grade;
 - Industrial/ Technical grade.
- MBS does not have a specific grade as a cooking fuel, as is the case in East Africa where ethanol with higher level of impurities (400ppm) is set aside for use as a household cooking fuel. It was mentioned that often 15 percent methanol is added for higher impurity fuel for a clean blue flame. Ethanol fuel is denatured with coloring and bittering agents to avoid risks of human consumption.
 - It was highlighted that Malawi will need a fifth grade of ethanol to be added as a specific cooking fuel grade ethanol.
 - It was also highlighted that the role of MBS was to lead and facilitate the process of standards development. However, the energy regulator, MERA, is the owner of the fuel and energy standards but relies on MBS for setting industrial standards. The MBS undertakes tests of energy sources and technologies on request by MERA. A similar process was followed when MERA sent the request for review of standards for blending alcohol.
 - Any stakeholder could initiate the process of development of a standard by writing a formal request through MERA. MERA needs to send the request for a review of standards to MBS.
 - The MBS would undertake literature review and search for similar standards from regional or international standards bodies for adaptation into a local standard. The MBS would draft the standards, present to its Technical Committee for a thorough review, and share with stakeholders for feedback.
 - The full review and standard creation would take four to six months for the complete cycle (draft to approval).
 - As regards stoves, there are no standards for ethanol stoves. However, there is on-going work right now to develop local standards for biomass cooking stoves. MBS has an old standard for paraffin stove. It was highlighted that the ethanol stove standard should be in line with international standard (ISO), with rating of about 1.4 kW burner.
 - MBS asked for available information on ethanol standards to be shared.

AGRICANE LIMITED

MEETING PARTICIPANTS		
NAME	TITLE	ORGANIZATION
Bouke Bijl	Agricultural Engineering	Agricane Limited
Bikash Pandey	Director, Clean Energy	Winrock International
Kenneth Gondwe	Consultant	Winrock International
Paul Harris	Consultant	Winrock International

Background

The objective of the overall assignment was to assess prospects for ethanol as a potential cooking fuel option for Malawi. A number of stakeholders have been consulted from the Government, the Regulator, the ethanol manufacturers and others in the value chain. One key element holding back the production of ethanol within Malawi was found to be the shortage of molasses, the key feedstock.

The team wanted to learn from Agricane what the prospects were for expanding sugar cane production in Malawi to overcome the shortage of feedstock.

Primary Message of Interview

- Agricane is working on a European Union funded project to support increase in sugarcane production in Malawi. This is in response to a request from the country's two distillers to the EU.
- Agricane finds the distillers might be overly optimistic about the amount of sugar cane they can access to provide them the necessary feedstocks. There are limitations both in the amount of land available and in the large upfront investment that would be needed both in terms of acquiring land and in investing in the necessary milling and processing equipment.
- Starting in 2013, PressCane and EthCo had tried to put in place an ambitious initiative called RAMA (for Raw Materials) to develop their own feedstock supply. This was abandoned on account of change in regulations in terms of packaging and distributing drinking alcohol in the country and due to the challenges of raising capital.
- The most likely prospects for increasing sugarcane production in Malawi come from the Shire Valley transformation program which has an objective of bringing 18,000 ha of new land under sugarcane cultivation. This \$200 million project is 5-8 years away from being completed.

PRESSCANE LIMITED

Meeting held 7 December 2020 via Zoom.

Present

MEETING PARTICIPANTS		
NAME	TITLE	ORGANIZATION
Dr. Christopher Guta	Chief Executive Officer	PressCane Limited
Bryson Mkhomaanthu	Chief Operations Officer	PressCane Limited
Hudson Kabanga	Process Manager	PressCane Limited
Masankho Madanisa	Sales & Marketing Manger	PressCane Limited
Kenneth Gondwe	Consultant	Winrock International
Paul Harris	Consultant	Winrock International

Background

Paul and Kenneth were introduced as part of the team tasked to develop rationale for ethanol as an urban cooking fuel to replace charcoal. The assignment was part of the Modern Cooking for Healthy Forests in Malawi (MCHF) project.

The objective of the overall assignment was to provide background information that could be used to provide justification for ethanol as a potential cooking fuel option for Malawi. This was in response of a call for grant worth 1.1 million US\$ that was launched last week. The grant would fund various activities in clean fuel that include, amongst others, alternative clean cooking fuels, efficient stoves, marketing and distribution of clean cooking fuels and cooking technologies and sustainable supply chain issues.

The team wanted to learn from PressCane about their operations and their potential to produce ethanol that could be used as a cooking fuel, building on the issues Kenneth noted during the visit to the factory a few weeks ago.

Primary Message of Interview

- PressCane was asked whether the company would be interested to diversify into supplying ethanol as fuel for cooking. It was mentioned the demand was estimated at 300,000 households (HH) but could start with supply of say 20,000 HH with estimated demand of 1.5 to 2 million liters per annum- this assumes using ethanol as supplementary fuel at rate of 6 liters/month. Full cooking is estimated at 15 liters/month.
- The ethanol grade used for cooking could accept higher levels of impurities and additives to improve burning efficiency.
- PressCane confirmed that there is currently no Technical Alcohol at around \$0.50/liter available in Malawi.
- However, PressCane emphatically said the company was interested to diversify from their principal product line (fuel ethanol for blending). The company also stated that they could be willing to divert a small quantity for a good cause to test the cooking ethanol market.
- PressCane raised the issue of pricing and quantities (demand) as critical.
- The company was working on expansion of their production capacity and position themselves for the future market opportunities. Current installed capacity is approximately 27 million liters (300days x 90,000 liter per day).
- The main constraint is feedstock. The company is working on production of own sugarcane to be used as feedstock in form of sugar juice or syrup.
- In the next 12 to 15 months, the company plans to install a pharma grade ethanol plant to handle own feedstock; This would lead to the availability when linked to EthCo developments of 0.8 million liters of TA within in 12-18 months.
- Although the current demand for fuel ethanol fuel for blending is guaranteed, the situation is bound to change due to changes in the auto industry and government policies (electric cars, future petrol grade for Malawi will require less than 20 percent ethanol in the blend).

- Currently the demand for fuel ethanol for blending is about 40 to 45 million liters per annum. The two ethanol producers are capacity falls far too short. Therefore, it is not possible to meet the projected demand for cooking fuel based on current mid-term projected capacities. However, the government could, as a matter of policy, order producers to set aside a certain proportion of production for cooking fuel purposes.
- Ethanol fuel marketers and distributors seek long term agreements that would ensure consistent supply to their customers.
- On importation of ethanol the following issues were noted:
 - PressCane made inquiries from Brazil;
 - FOB Price range similar to what was reported for Kenya (about 45-50 US cents). Landed price in Malawi was estimated at 85 US cents;
 - Need for volumes and guaranteed market price;
 - It was suggested that the target price should be slightly below LPG, say 1 US \$/ liter.
- Small-scale production of ethanol as a cooking fuel was investigated by Malawi University of Science and Technology (MUST). Challenges on the cost of production especially feedstock (Cassava) and concentration of ethanol;
- PressCane is also working on biogas project to meet own thermal energy demand and sale excess to other users.

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