

GAIA Association

Holistic Feasibility Study of a
**National Scale-up Program for Ethanol Cook Stoves and
Ethanol Micro Distilleries (EMDs)**

Private Sector Development Strategy

December 2014

Executive Summary

Ethanol is commercially supplied to about 3,000 households in Addis Ababa. In addition, the UNHCR provides ethanol for cooking for 3,500 households in refugee camps. Commercial consumers are supplied by two private enterprises that provide both the fuel and stove to them. Private enterprises and smallholders are engaged in sugar cane production as out growers to state sugar factories and for supply in the open market; smallholders also produce other potential ethanol feedstock including sweet sorghum, sweet potato, beetroot, prickly pear cactus and other sugar and starch crops. Private enterprises provide support activities in the ethanol supply chain including finance (private commercial banks), parts and equipment, and transport.

The present commercial market for ethanol for cooking is about 0.15 million liters annually (supplied to fewer than 3,000 households). The market for ethanol as cooking fuel is still very small, as is the business volume and income. Market development is essential for the engagement of more and larger ethanol distributors in the business as well as to increase ethanol production. Coherent and sustained market development is the most important action for making ethanol a true cooking fuel alternative. Such coherent market development will have policy and regulatory, promotion and marketing, financing, R&D, and other market support dimensions.

Existing ethanol fuel and stove distributors as well as petroleum distribution companies (which are potential new distributors for ethanol) indicate the critical importance of policies for commercialization of ethanol as cooking fuel. In particular, they point out that ethanol fuel allocation and its pricing for cooking has been uncertain and this has had detrimental impact on market development. They point to the need to develop the market for the fuel by first ensuring ethanol supply at competitive prices.

- *Recommendations:* Make rationale economic, social and environmental valuation of the benefits and costs of using ethanol for cooking, as gasoline blend or for export. Allocation and pricing of ethanol among the alternative uses should be based on such rationale valuation not on enterprise level decisions.
- Provide substantial and growing allocation of ethanol for cooking at stable prices. The allocation for 2006EFY was 2 million liters and allocations in the near future should be kept at this level. Supplier and consumer prices need to be stable at levels that will make ethanol competitive with kerosene and LPG.

Ethanol is distributed by two private enterprises from two distribution facilities within Addis Ababa. These facilities are small, located in residential neighborhoods with basic environmental and safety standards. They are also not easily accessible for most consumers. Regulations similar to petroleum fuels may soon be in place for distribution of ethanol which existing facilities may not meet.

- *Recommendations:* appropriate distribution locations need to be provided for ethanol distributors to improve consumer access as well as to meet distribution standards. Support should be provided by city governments to allocate land and permits for distributors.
- Incentives must be provided for petroleum distribution companies to make investment in ethanol distribution. Petroleum companies will invest in distribution when they know there is substantial market for the fuel and when they are guaranteed sufficient margins for fuel distribution (margins to include additional investment cost in ethanol distribution).

Ethanol fuel distributors also supply ethanol stoves to their customers. One company manufactures the stove while the other supplies imported stoves. The price of the locally manufactured stove is a third of that of the imported stove (ETB 385 for local stove, ETB 1,350 for imported stove). Both companies are in the initial stages of setting up medium scale stove manufacturing plants. MOWIE has developed an ethanol stove and has trained micro enterprises for its manufacture. Local manufacture has reduced stove prices but current local manufacture quality need to be improved (manufacture precision, finish).

- *Recommendation:* stove technical quality standards are being developed; ethanol stoves should be included in such standards. Technical performance as well as environment and safety considerations should be part of the standards. Existing distributors of stoves are setting up medium level mechanized manufacture facilities which will improve quality; these will also be easy to regulate (compared to numerous micro enterprises producing the stove).

Private investment in ethanol distilleries is welcomed by the government. Local private companies have shown interest to make investment in large distilleries based on molasses that may be available from state owned sugar factories. Private enterprises may also invest in micro and small ethanol distilleries including feedstock production if policy guidance is provided for feedstock production (e.g. sugarcane or sweet potato cultivation for ethanol production) as well as ethanol pricing.

- *Recommendations:* Provide policy guidance for feedstock cultivation for ethanol production to increase and diversify ethanol production sources and to attract investment.
- Provide incentives for private investment in ethanol distilleries and feedstock production. There is already such a plan by the government but this plan must be pursued strongly. Investors also seek competitive and stable prices for inputs (molasses purchases) and ethanol.

There is local manufacture capacity for manufacture of some components of ethanol micro distillery equipment. This capacity is distributed in several small to large manufacturing enterprises. Local manufacture and installation capacity will improve if the market for EMDs grows. The private sector needs support in technology transfer and technical skill development.

- *Recommendation:* local private enterprises can be linked with foreign manufacturers and suppliers of EMDs for technology transfer; technical support in the form of technical designs and specifications can also be provided to ease engagement of local enterprises in EMD supply (part of this feasibility study). Limiting EMD tenders to local suppliers will guarantee markets for local companies and facilitate technology transfer.

Financing is a major barrier for private enterprise in Ethiopia. Financing is required for all segments of the ethanol fuel supply chain and support activities but it is not easily accessible. Private investors, for example, have tried to take up the government plan to promote private investment in ethanol distilleries from molasses waste from state owned sugar factories but have failed the required capital. Ethanol fuel and stove suppliers have relatively low requirements for financing because the small market they serve today but their need will increase with expanding market. Credit terms from commercial and development banks (knowledge of the sector, equity and credit guarantee requirements) are not attractive for investors.

- *Recommendation:* financing for renewable energy technologies (RETs) require special consideration because RETs products and the demand for them is still not known by banks. Banks thus require technical assistance for developing credit lines for RETs including ethanol fuel and equipment; they also need some risk sharing support (for instance credit guarantees). There are ongoing projects to provide such support (for instance, World Bank fund at the DBE) to banks and effort should be directed to including ethanol into such programs.

Research on ethanol is conducted at a very limited level to developing (adopting) an ethanol cook stove for households. R&D in ethanol production (micro to large) and use for commercial uses is yet to be initiated. While some plans exist for developing or adopting low-cost oil extraction technologies (kind of micro refineries for biodiesel crops) there are no similar plans for ethanol. If decision is made for large scale adoption of ethanol as cooking fuel in Ethiopia, this plan should be supported by localization of key production and use technologies within the country.

- *Recommendation:* R&D on ethanol micro distilleries and ethanol stoves should be part of the R&D plan at MOWIE; MOWIE should collaborate with relevant industries and universities particularly for the localization of EMDs in Ethiopia. Finance for such R&D should be sought from local and external sources.

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Acronyms and Abbreviations

AETDPD	Alternative Energy Technology Development and Promotion Directorate
BDS	Business Development Services
CRGE	Climate Resilient Green Economy (Strategy)
CSA	Central Statistics Agency
DBE	Development Bank of Ethiopia
EC	Ethiopian Calendar (Starts 11 September, ends 10 September)
EDRI	Ethiopian Development Research Institute
EE	Energy Efficiency
EFY	Ethiopian Fiscal Year (Starts July 8, ends July 7)
EMD	Ethanol Micro Distillery
EREDPC	Ethiopian Rural Energy Development and Promotion Center
ERG	Ethio Resource Group
ESA	Ethiopian Standards Agency
ETB	Ethiopian Birr
FAO	Food and Agriculture Organization (of the UN)
FDRE	Federal Democratic Republic of Ethiopia
FEMSEDA	Federal Micro and Small Enterprises Development Agency
GHG	Greenhouse Gases
GTP	Growth and Transformation Plan
ha	hectare
HoAREC&N	Horn of Africa Regional Environmental Centre and Network
IAP	Indoor Air Pollution (Pollutants)
IBRD	International Bank for Reconstruction and Development
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFC	International Finance Corporation (a member of the World Bank Group)
IFPRI	International Food Policy Research Institute
kg	kilogram
L	Liter
LPG	Liquified Petroleum Gas
MEF	Ministry of Environment and Forest
METEC	Metals and Engineering Corporation
MFI	Micro Finance Institutions
MLI	Medium and Large Industry
MOA	Ministry of Agriculture
MOI	Ministry of Industry
MOT	Ministry of Trade
MOWIE	Ministry of Water, Irrigation and Energy
MSE	Micro and Small Enterprise
NAMA	Nationally Appropriate Mitigation Actions
NBE	National Bank of Ethiopia
NGO	Non-Government Organizations
NOC	National Oil Company
PGI	Project Gaia Incorporated
q	quintal
R&D	Research and Development
RDPS	Rural Development Policy and Strategy
RE (T)	Renewable Energy (Technology)
REF	Rural Electrification Fund
SCIP	Strategic Climate Institutions Program (Funding source for this study)
SNNP(RS)	Southern Nations, Nationalities and Peoples Regional State
SREP	Scaling up Renewable Energy Project
UNHCR	United National High Commission for Refugees

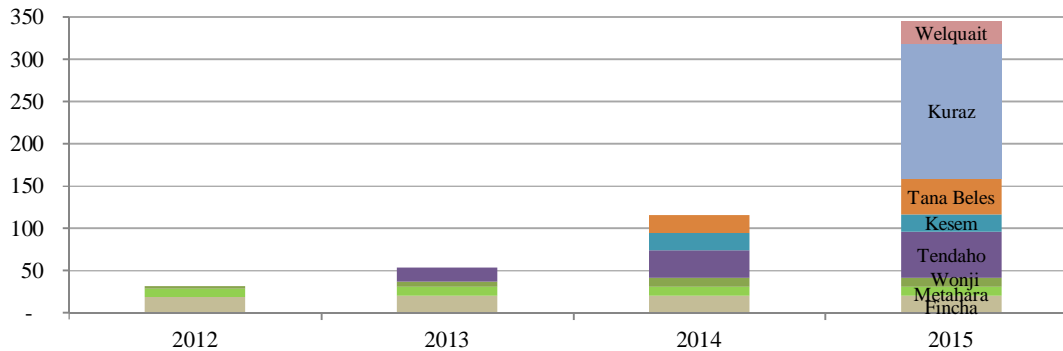
1. Background

1.1 The ethanol market in Ethiopia

Ethiopia seeks to become a major sugar producer in the next five years. The current national plan, the Growth and Transformation Plan (GTP), envisaged increasing sugar production from 17.7 million tons in 2010 to 42.5 million tons in 2015, a 240% increase in just five years. This rise in sugar production will be accompanied by rise in sugar processing waste including molasses and sugar cane bagasse. The government plans to use molasses waste to produce ethanol.

Total current production of ethanol is 14.6 million liters (2006EFY). Ethanol production is expected to rise to 134 million liters in 2016. Ethanol is produced mainly from government owned sugar factories;¹ the government is expected to remain the main source of ethanol in the future because of its large scale production plan. Fuel ethanol is currently not produced by private companies in Ethiopia but there is some potential because of private investment in sugar production but also because the government is considering private investment in ethanol plants for selected government owned sugar factories.

Figure 1.1 Ethanol production and production plan, 2011 – 2020
(This was the plan in 2011, now delayed by several years)



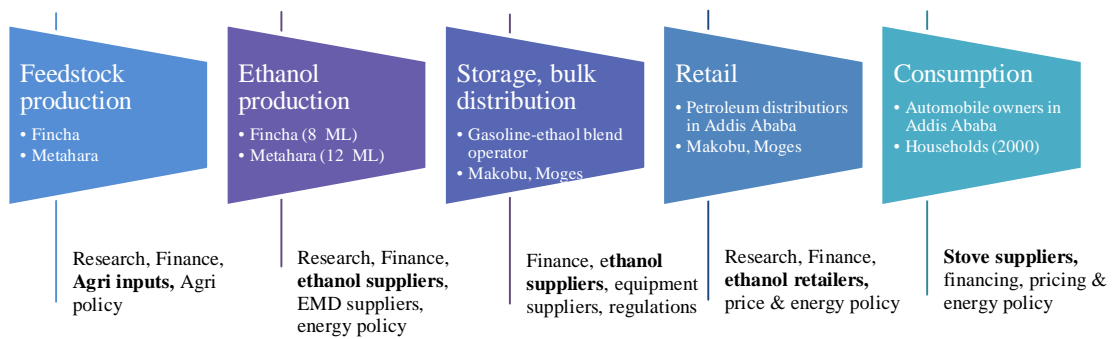
The large proportion of the ethanol produced in Ethiopia is used as gasoline blend in Addis Ababa. In 2013 the amount used as gasoline blend amounted to 14 million liters. The ethanol gasoline blend mandate was initially set at 5% by volume in 2009 and raised to 10% in 2011; this puts the annual amount required for gasoline blend at 20 million liters for 2013. Ethanol used as gasoline blend is blended by three oil companies (National Oil Company, OilLibya, and Nile Petroleum).

In 2013 the volume of ethanol used as cooking fuel was 0.15 million liters. All the ethanol supplied for cooking fuel is sold through two private companies (Makobu Enterprises and Moges Haile-Selassie Metal Manufacturing) through the market, and by the UNHCR and Gaia Association to refugee camps in Ethiopia. The private enterprises distribute ethanol from their distribution facilities (one each) in Addis Ababa.

The ethanol supplied for gasoline blending is 99% ethanol by volume, whereas the ethanol supplied for cooking is only 95% ethanol by volume. The price paid for ethanol sold for the gasoline blend is and for cooking is Birr 10.78/liter. The retail price for E5 ethanol-gasoline blend in Addis Ababa is Birr 20.45/liter (July 2014). The retail price for ethanol sold for cooking is Birr 13.99/liter.

¹Potable alcohol companies produced relatively small volumes of ethanol using molasses purchased from government factories.

Figure 1.2 The value chain for ethanol fuel in Ethiopia

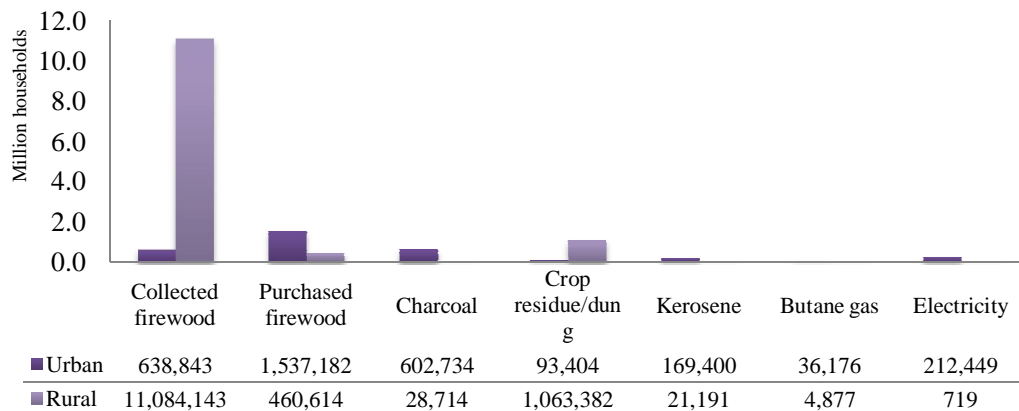


Ethanol production is expected to rise rapidly in the next few years (Figure 1.1). Production is expected to surpass amount required for gasoline blending as long as the blending mandate does not exceed E10 (10% ethanol by volume). This means alternative markets must be found for ethanol produced. Cooking is an attractive market for ethanol because

- It will replace kerosene and LPG used for cooking by households (and commercial customers) which will proportionally reduce import of these fuels;
- Lower cooking costs for consumers because of the high performance of cooking with ethanol and ethanol stoves;
- It will have positive impacts in improving the kitchen environment for households using kerosene; and
- It will contribute to reducing greenhouse gases from kerosene and LPG stoves.

There were more than 200,000 households using kerosene and LPG as their main cooking fuel in Ethiopia. Since the cost of cooking with ethanol (and the CleanCook stove) is lower than that of kerosene and LPG a large segment of kerosene and LPG consumers can be expected to switch to ethanol if supply is stable (availability and pricing). Switch by 50% of kerosene and LPG users to ethanol will create a market for 40 million liters of ethanol.

Figure 1.3 Cooking fuel use in rural and urban areas of Ethiopia, 2011



Source: CSA, 2012. Welfare Monitoring Survey 2011

1.2 Objectives

The **overall objective** of the project is to contribute to the development of the bio-ethanol sub-sector in Ethiopia by analyzing the feasibility of ethanol micro distilleries and ethanol fuel for cooking and articulating an action plan.

The **specific objective** of the assignment is to provide a comprehensive analysis of the Ethiopian cooking market including fuels and devices in use, consumption and expenditures, consumer preferences and willingness to pay, estimate market size for ethanol fuel and stove, analyze the cooking fuels and devices competitive landscape, distribution channels, and mapping out key stakeholders and their roles and potential contributions in ethanol fuel and stove market development.

The **private sector development component of the study** focuses on identifying the constraints for private sector actors in the ethanol value chain and making recommendations to address them. In particular it will

- a. Review the policy environment for private sector engagement in the ethanol market and make recommendations for policy and regulatory support to the sector;
- b. Identify financing barriers for the private sector and recommend financing sources and financing mechanisms to address these barriers; and
- c. Identify non-financial barriers for the private sector and provide recommendations to address them including through technical and business capacity development.

1.3 Methods

The study employs review of documents, interview with key stakeholders, consultation with members of the feasibility team, and input from stakeholders on findings of the study.

- a. Review of policies for private actors in the ethanol value chain;
- b. Review of international experience for promotion of ethanol as cooking fuel (including market models) and successful support for the private sector;
- c. Interview with private sector actors in the ethanol value chain, support institutions (financing, technical and business support), and policy making institution;
- d. Consultation with members of the feasibility team (marketing, household energy, economist);and
- e. Feedback from review by stakeholders of findings from the feasibility study.

The study maps the value chain for ethanol fuel in Ethiopia, including existing and potential actors (e.g. micro distilleries); support structure (e.g. inputs such as ethanol stoves, or support such as finance), and the policy framework.

Chain	Description	Enterprises(public, private, coop)	Support institutions	Macro enablers
Production	Sugar cane farms, sugar and other waste producers	Feedstock producers	R&D, inputs (crop seeds to equipment and machinery), transport, extension/promotion, finance, technical and business capacity development	National policies and regulations: Agriculture, Industry, Trade, Investment, Environment, Energy, Quality and standards, Prices
Processing	Fuel ethanol production	Ethanol producers		
Distribution	Bulk transport and distribution	Bulk ethanol suppliers		
Retail	Retailers to final consumers	Ethanol fuel retailers		
Consumption	Ethanol fuel consumption	Ethanol fuel consumers		

2. Policies and institutions for private sector engagement in the ethanol market

National policies in Ethiopia support domestic production, import substitution, efficiency and environmental sustainability. These are all areas where cooking with ethanol will have positive contributions. These principles are incorporated in sectoral, sub-sectoral and cross-sectoral policies including the Energy Policy (1994), the Bio-fuels Development and Utilization Strategy (2007), the Environment Policy (1997), the Industry Development Strategy (2002), and the Investment Proclamation (2012).

Awareness of the role of energy in the development process has grown in Ethiopia. Today the government is investing heavily in the sector and promotes energy efficiency and renewable energy. The energy sector is given high priority in the current national plan (the GTP) where 40% of the total investment goes towards it mainly to build the power supply and distribution infrastructure. The government seeks to integrate environmental sustainability into the development agenda and now has an ambitious agenda of mitigating local environmental degradation, greenhouse gas emission reduction and climate resilience (CRGE, 2011).

The government supports private enterprise through supportive policies including import and export incentives (tax exemptions), and financing incentives (ready financing from the government owned Development Bank of Ethiopia for manufacturing industry). The industry and investment policies support domestic production for the local market and particularly for export. Government and non-government agencies are providing capacity development support to micro and small enterprises (private and cooperative).

2.1 Policy context for using ethanol as cooking fuel

National energy and environment policies put access, domestic resource mobilization, sustainability and governance at their center. Energy access is promoted through increased domestic energy production and diversity for energy sources. Sustainability is promoted through efficiency and transition to more sustainable resources. Governance is enhanced through improved role for women and youth, increased engagement of the private sector, and improved performance of the public sector.

Goals from relevant policies are summarized below together with the potential contribution of cooking with ethanol to meeting these goals:

- a. Cooking with ethanol contributes to increasing energy access because it improves the diversity of cooking energy sources, improves overall cooking efficiency, and because it lowers cooking costs to users;
- b. Large scale adoption of ethanol as cooking fuel will increase local resource development and contributes to forest resource conservation (replacing biomass fuels);
- c. Cooking with ethanol promotes sustainability by reducing pollution exposure to pollutants inside the home from petroleum and biomass fuels, by reducing non-sustainable harvest of forests, and by reducing greenhouse gas emissions from petroleum and non-renewable biomass; and
- d. Large scale adoption of ethanol as cooking fuel will create a sizable local industry in the production and distribution of ethanol fuel and stoves thus creating jobs and enhancing self sufficiency.

Early policies such as the Energy Policy (1994) and the Environment Policy (1997) have stated the need to introduce alternatives to biomass fuels but did not identify ethanol as a potential alternative. Recent strategies have overlooked ethanol as cooking fuel: the climate resilient Green Economy Strategy (2011) considered LPG as a possible alternative to biomass for 0.3 million households by 2030 but not ethanol; the Nationally Appropriate Mitigation Action (NAMA, 2010) mistakenly puts biodiesel as a potential cooking fuel rather than ethanol. Even in the Bio-fuel Development and Utilization Strategy (2007) the financial and economic viability of ethanol as cooking fuel is put into

doubt due to inappropriate valuation of prices (of gasoline for automobiles and kerosene for cooking) where market prices were used instead of economic prices to compare economic benefits.

Table 2.1 Summary of key issues and policies relevant to cooking with ethanol

	<i>Access</i>	<i>Natural resource use</i>	<i>Sustainability</i>	<i>Governance</i>
Energy policy (1994)	<ul style="list-style-type: none"> ▪ RE and EE for the household sector ▪ Shift to modern energy 	<ul style="list-style-type: none"> ▪ Hydropower ▪ Alternative fuels 	<ul style="list-style-type: none"> ▪ Mitigate local environment degradation 	<ul style="list-style-type: none"> ▪ Self reliance, strong institutions, participation
Draft National Energy Policy (Feb 2013)	<ul style="list-style-type: none"> ▪ Increase ethanol production to 181 million liters by 2015 ▪ Challenge in distribution capacity for ethanol for cooking and high stove prices 			<ul style="list-style-type: none"> ▪ Recognizes the low level of participation of the private sector in energy services ▪ Promises to create favorable environment for private enterprise ▪ Challenge of financing, technology transfer, integration in the supply/value chain
Environment Policy (1997)	<ul style="list-style-type: none"> ▪ Substitute fuel wood, promote RE 	<ul style="list-style-type: none"> ▪ Ensure renewable resources are used sustainably 	<ul style="list-style-type: none"> ▪ Ensure resource sustainability ▪ Prevent pollution of land, air and water 	<ul style="list-style-type: none"> ▪ Ensure participation in environmental management
Biofuels Development & Utilization Strategy (2007)	<ul style="list-style-type: none"> ▪ Cooking was considered as one of the potential uses of ethanol produced in Ethiopia 			
GTP (2010); MOWIE Strategic Plan (2011)	<ul style="list-style-type: none"> ▪ RE and EE for cooking ▪ Ethanol production to increase to 182 million liters by 2015. 		<ul style="list-style-type: none"> ▪ Climate resilience ▪ GHG mitigation ▪ Reforestation ▪ Add 9 million improved stoves by 2015. 	<ul style="list-style-type: none"> ▪ Empower women and youth
CRGE (2011)			<ul style="list-style-type: none"> ▪ Reduction forest degradation from biomass fuel use (substitution, efficiency) 	
Cooking with ethanol	<ul style="list-style-type: none"> ▪ Substitutes biomass and fossil fuels ▪ Raises energy efficiency ▪ Lowers cooking cost 	<ul style="list-style-type: none"> ▪ Promotes indigenous resource use ▪ Cuts import dependence 	<ul style="list-style-type: none"> ▪ Promotes resource conservation ▪ Removes IAP ▪ Reduce GHG 	<ul style="list-style-type: none"> ▪ Promotes RE enterprise ▪ Creates jobs (empowers youth)

2.2 Policy context for private enterprise

2.2.1 Public and private enterprise for agriculture and manufacture in Ethiopia

Agriculture

Smallholder crop production is still dominant in Ethiopia where 96% of the cultivated area and output is from smallholder farmers (2012/2013). Crops where medium and large commercial farms (which include both private and state owned farms) make significant contribution include cotton (100% of total production), sugar cane (78%), sesame (43%), oil seeds (19%), and coffee (19%). Sugar cane production is dominated by commercial state farms. Root crops that may be used as feedstock for ethanol (beetroot and sweet potato) are cultivated mainly by smallholder farmers.

Productivity is higher for commercial farms compared to smallholder farms across all crops but they are significantly higher for sugar cane, fruits and vegetables.

Table 2.2 Area, production and yield for commercial farms, 2010/2011

Crop	Area (ha)	Production (quintal)	Yield (q/ha)	Area (%)
Cereals	181,773	6,112,919	33.6	29.5%
Pulses	13,045	212,515	16.3	2.1%
Oil seeds	257,426	3,001,978	11.7	41.8%
Vegetables	7,309	1,403,234	192.0	1.2%
Root crops	4,420	996,331	225.4	0.7%
Beetroot	2.9	496	172.8	
Sweet potato	156	49,400	316.7	0.08%
Fruits	5,267	706,119	134.1	0.85%
Sugar cane	21,100	30,459,650	1,443.6	3.4%
Other crops (coffee, tea, chat, others)	122,088	2,139,976		
Total	616,463	46,410,553	75.3	

CSA, 2011. Large and Medium Sale Commercial Farms Survey, 2010/11

Table 2.3 Area, production and yield for private smallholder holders, 2012/13

Crop	Area (ha)	Production (quintal)	Yield (q/ha)	Area (%)
Cereals	9,601,035	196,511,515	20.5	71%
Pulses	1,863,445	27,510,312	14.7	14%
Oil seeds	818,449	7,266,644	8.9	6%
Vegetables	192,555	8,523,083	44.3	1%
Root crops	203,958	36,298,616	178.0	2%
Beetroot	1,795	168,485	93.8	
Sweet potato	41,634	11,850,508	284.6	
Fruits	61,972	4,793,360	77.3	
Sugar cane	22,388	10,398,657	464.4	0.2%
Other crops (chat, coffee, hops)	725,540	5,859,548		5.4%
Total	13,489,342	297,161,735		

CSA, 2013. Area and Production of Major Crops (private peasant holdings, Meher season), 2012/13

Manufacture

In 2008 there were 43,338 small-scale industries (SSIs) employing 138,951 with total output of Birr 2.8 billion.² Main SSIs in terms of number of enterprises and value of production are grain mills, furniture manufacturers and metal product manufacturers.

The main problems faced by SSIs to start business were start-up capital (for 40% of enterprises), supply of raw materials (5.7%), government regulations (5.3%), and skilled labour (4.1%). Problems associated with low capacity utilization include market demand, supply of raw materials and parts, foreign exchange, market demand, and utilities (power and water). Government related SSI challenges include long wait for licenses and work permits.

A total of 2,172 medium and large scale industries employing 186,799 people were operational in 2010.³ Important industry groups include food and beverages (35% of value added), non-metallic minerals (19%), chemicals (8%), and rubber and plastic (7.4%). The total output from all such industries was Birr 40 billion. Private enterprises accounted for 94% of the enterprises operating in the country and for 69% of the output. The government sector is still important and accounts for 31% of total manufacturing output. Manufacturing industry has expanded rapidly over the previous four years with nearly threefold increase in output (14.9 in 2006 to 42.0 in 2010).

Medium and large scale industries in Ethiopia have low capacity utilization (68% in 2010). Public enterprises performed better (79%) compared to private enterprises (64%). Industry groups with

² CSA, 2010. Report on small scale manufacturing industries survey.

³ CSA, 2011. Report on large and medium scale manufacturing and electricity industries survey.

particularly low capacity utilization include basic iron and steel (36%), wood and wood products (49%), leather preparation and leather products (53%), chemicals and chemical products (56%), and rubber and plastic (57%). Main reasons for low capacity utilization reported by the enterprises include inadequacy in raw material supply (and foreign exchange), market demand, credit facility, and power, in that order. Manufacturers did not consider government regulations or labour skills as major constraints.⁴

2.2.2 Public and private enterprise engagement in the ethanol supply chain

Enterprises that are of interest for this feasibility study consist of enterprises involved in the production, distribution and consumption of ethanol and those that provide inputs to them. The main actors in the value chain are producers of ethanol feedstock, ethanol producers, distributors and retailers. Enterprises that provide inputs in the value chain include equipment suppliers to ethanol producers and stove producers and distributors. Large, small and micro enterprises are involved (will be involved) in the ethanol value chain.

Feedstock production	<ul style="list-style-type: none"> ▪ Government sugar enterprises now in operation and in the plan. ▪ Commercial agriculture and agro-processing industry for sugar cane, other sugar crops, and starch crops (medium and large scale). ▪ Smallholders producing sugarcane, sweet sorghum, sweet potato, prickly cactus fruit, and other sugar and starch crops.
Ethanol production	<ul style="list-style-type: none"> ▪ Government enterprises (Fincha and Metahara) producing ethanol from sugar cane molasses. New ethanol plants in the plan. ▪ Private investment in ethanol production from molasses available from selected government sugar factories is possible in future. ▪ Ethanol micro distilleries based on molasses waste from government sugar factories or feedstock from smallholder sugar cane, sweet sorghum and other crops.
Marketing/distribution	<ul style="list-style-type: none"> ▪ Ethanol fuel for cooking is distributed by two private enterprises in Addis Ababa. ▪ Petroleum distribution companies may get involved in the future if market becomes large enough.
Inputs and support functions	<ul style="list-style-type: none"> ▪ Ethanol stoves are manufactured and supplied to consumers by one private enterprise and imported and distributed by another. ▪ Some components of ethanol distillery (medium and micro scale) equipment may be manufactured locally in the future.

2.2.3 Policies and strategies for private enterprise in Ethiopia

Ethanol fuel production involves agriculture (feedstock), industry (agro-processing and manufacturing), and service (transport and distribution). Policies related to agriculture, industry, investment and trade are important for promotion of ethanol as a viable alternative cooking fuel in Ethiopia.

Rural Development Policy and Strategy (2002). This strategy stressed the importance of agriculture as the source of livelihood for a large segment of the population and as the principal economic activity in Ethiopia. Agriculture is also considered important as the foundation for industry. The strategy has the following main elements:

⁴CSA, Report on Large and Medium Scale Manufacturing and Electricity Industries Survey, 2011.

Labor intensive rather than capital intensive strategy for agriculture (employ abundant and underutilized labor force in rural areas, conserve limited capital available, distribute benefits across large section of the population through increased employment and income).

Appropriate land use (agro-ecologically appropriate utilization of land, increase productivity of land through irrigation, multi-cropping and other means).

Integration within the agriculture sector itself (e.g. crop and livestock, different agricultural products and activities) *and with other sectors* (e.g. education, health and infrastructure).

Industry Development Strategy (2002). The strategy underlines the fact that Ethiopia follows a market economy and that the private sector will be the engine of growth of the economy including industry. The strategy puts agriculture as the foundation for industrialization, gives priority for export oriented and labour intensive industries, and specifies the roles of government, foreign and domestic investors. The strategy gives priority to specific sub-sectors including textile and garments, leather and leather products, and agro-processing.

Agriculture development led industrialization: in consideration of agriculture as the domestic source of industrial inputs and as market for industrial outputs.

Export oriented industrialization: in order to foster internationally competitive industries and to exploit large markets.

Labour intensive industries: in consideration of the abundance of labour and its competitiveness.

Effective domestic and foreign investment partnerships: in consideration of domestic capital, technological and managerial limitations and the potential contribution of foreign investment to fill these limitations as well as to address export markets.

Leading and managerial role of the government: to create and maintain favorable conditions for private investment, to engage in areas where capacity of private enterprise is limited. Favorable conditions for private investment include sustainable growth, modern financial system, infrastructure, human resource development, and efficient tax collection system.

Agricultural Sector Policy and Investment Framework (PIF, 2011).⁵ The PIF is a ten-year plan that provides priorities for investment in agriculture. The PIF recognizes the importance of the agriculture sector for growth and poverty reduction and that although the sector had performed well in the previous decade there was particular need to increase productivity and market linkages for smallholder farmers. Although Ethiopia has policies, strategies and plans in place the institutional capacity to implement them was considered limited. The PIF has four thematic areas with the following objectives:

Increase productivity of smallholder agriculture: to increase productivity and production.

Rural commercialization: to accelerate agricultural commercialization and agro-industrial development.

Promote natural resource management: to reduce natural resource degradation and improve productivity of natural resources.

Disaster risk management and food security: to achieve universal food security and protect vulnerable households from natural disasters.

Investment Proclamation No. 769/2012. The current investment proclamation is the fourth revision of the investment code since 1992. The latest revision is made to expand investment in manufacturing, to increase the inflow of capital and technology, promote equitable distribution of investment among the regional states, and to promote the creation of industrial development zones to increase investment.

⁵ Ministry of Agriculture and Rural Development, 2010. Ethiopia's Agricultural Sector Policy and Investment Framework (PIF) 2010-2020.

Areas of investment reserved for the government or joint investment with the government: investment in transmission and distribution of electric power, postal service and air transport (for more than 50 passengers) are reserved for the government; investment in manufacture of weapons and telecom services are possible only in joint venture with the government.

Minimum capital requirements for foreign investors: the minimum capital for foreign investors is US\$200,000 for a single investment project; US\$150,000 if joint investment with domestic investor; US\$100,000 for foreign investment related to design and consulting works; US\$50,000 joint investment in design and consulting works with domestic investor.

Remittance of funds: profits and dividends, principal and interest payments on external loans, proceeds from the transfer of shares, and proceeds from the sale or liquidation of enterprise.

Tax and other investment incentives. Ethiopia provides tax incentives including income tax holidays, import duty exemption for raw materials used as input and for capital goods, and investment credit support for selected industries (mainly export oriented).⁶

Income tax holidays: investments in approved agriculture, agro-industry and manufacturing projects are exempt from income tax for several years after the project become operational. The duration of tax holiday depends on the type project and the geographic location of the project within Ethiopia.

Customs import duty: Investors can import capital goods and spare parts (worth 15% of the value of the capital goods) without any custom duties and other taxes (100% exemption). Capital goods imported for investment can be transferred to other investors with similar tax privileges. Investors are also exempt from customs duties and other taxes levied on import of raw materials necessary for the production of export goods.

Export custom duties: custom duties and other taxes are waived for all exports from Ethiopia.

2.2.4 Private enterprise support framework in Ethiopia

The government provides support to enterprises through sector institutions (Ministries at the Federal level and Bureaus in the regions) and through dedicated support agencies. Micro and Small Enterprises (MSEs) are supported through MSE Development Agency (FeMSEDA at the federal level ReMSEDA at the regional level); medium and large scale enterprises are supported through the Ministry of Industry (and Bureaus of Trade and Industry at the regional level).

The government provides extensive support to MSEs through its regional and city MSEDAs including MSE organization, technical and business training, provision of work space, financing, and marketing. Support for medium and large scale enterprises is through tax incentives (tax exemption for import of capital goods and for exports), and loans from the state owned Development Bank of Ethiopia (DBE) for export industries. One ethanol stove manufacturer, *Moges Haile-Selassie*, has received work space while he was an MSE then investment license and land for construction of the workshop after he graduated to medium scale manufacturing level.

Some sectoral ministries have created specialized units to support MSEs. The Ministry of Water, Irrigation and Energy (MOWIE) has such a unit that helps organize MSEs working in the water and energy areas. This unit will support the organization and training of stove producers (including ethanol stove producers) together with the AETDPD and the Biofuel Development and Coordination Directorate.

Regional Bureaus for Children, Youth and Women's Affairs are also involved in the selection and organization of Youth and Women's groups in MSEs for various manufacturing and service

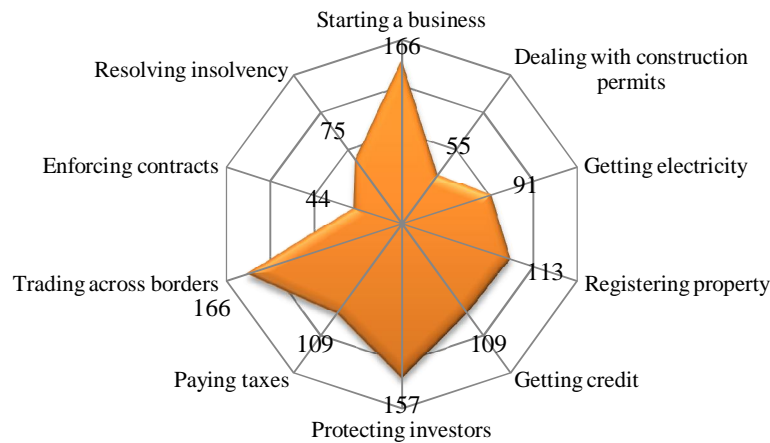
⁶ KPMG, 2011. Ethiopia Fiscal Guide 2012/13

enterprises. They have been working with Regional Bureaus of Energy in support of Women’s wood stove manufacturing and marketing enterprises.

2.2.5 Ease of doing business in Ethiopia

Ethiopia ranks poorly in international doing business indices. It does badly in all but two of the ten indices used for measuring ease of doing business by the World Bank (enforcing contracts and dealing with construction permits).⁷Ethiopia’s overall ranking has slightly declined in the past year where it is ranked at 125 (of 189 countries) compared to 124 in 2013. It does particularly badly in starting a business (166 of 189), trading across borders (166 of 189), and protecting investors (157 of 189). Access to infrastructure (e.g. electricity) and credit are also major constraints to businesses in Ethiopia.

Figure 2.1 Doing Business Indices for Ethiopia (from 189 countries), 2014

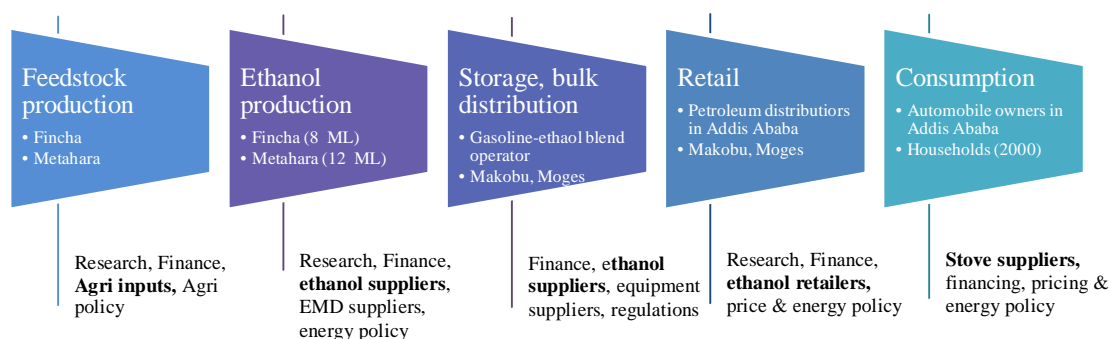


Source: IBRD/World Bank, 2013. Doing Business

⁷*Doing Business* provides an aggregate ranking on the ease of doing business based on indicator sets that measure and benchmark regulations applying to domestic small to medium size businesses through their life cycle (IBRD/World Bank, 2013).

3. The ethanol value chain

The ethanol supply chain involves the main activities and actors for feedstock production, ethanol production, distribution and final consumption. Both government and private companies are involved in the supply of ethanol for cooking in Ethiopia. The government is the sole producer and private enterprises are the only distributors of ethanol for cooking: two government sugar factories produce ethanol, two private enterprises distribute and retail ethanol, and about 3,000 households use ethanol for cooking (all in Addis Ababa).



The ethanol value chain also consists of institutions that provide inputs to the main actors in the chain including input suppliers (fertilizer; equipment suppliers for agriculture, distribution, and end use), research agencies, financing institutions, and policy makers.

3.1 Value chain actors and activities

3.1.1 Feedstock production

The only existing feedstock currently used for ethanol production in Ethiopia is molasses from the sugar refining process in two government factories. Future plans for ethanol production by the government are also based on molasses from sugar cane processing as the feedstock. There are no plans to produce ethanol directly from cane juice or from other alternative sources by the government or private enterprises.

Table 3.1 Sugar cane production by smallholder farmers and private commercial farms in Ethiopia

	Private peasant holdings, 2005 EC (2012/13)			
	Holdings	Area(ha)	Production (q)	Yield (q/ha)
Ethiopia	1,068,121	22,388	10,398,657	464
SNNP	622,128	12,014	6,454,540	537
Oromiya	337,823	7,594	2,153,107	283
	Commercial farms, 2003 EC (2010/11)			
	Holder	Area(ha)	Production (q)	Yield (q/ha)
Ethiopia	State owned	21,099	30,459,650	1,444

CSA, 2013. Report on Area and Production of Major Crops (Private peasant holdings, Meher season).
CSA, 2011. Large and Medium Scale Commercial Farms Sample Survey, Volume VIII

Land cultivated to sugar cane by smallholder and private commercial farms in Ethiopia total about 44,000ha with total can production of about 4 million tons annually. SNNP and Oromiya are the main

production centers for sugar cane by smallholders; the major sugar cane production zone in SNNP is Sidama with 55% of production in region. Oromiya is an important center for production of sugar cane by commercial farms (which are mostly federal government owned farms). Smallholder sugar cane holding are very small in Ethiopia at just about 0.02ha per holder. Smallholder cane production is mainly carried out as a supplementary source of cash income. Cane output is sold for chewing at high prices in local markets (and major cities around the country).

Two private companies, one Ethiopian and the other Indian, have started cultivating sugar cane. The Ethiopian company (Hiber) now produces cane to supply a government sugar factory. The Indian company located in East Wellega zone of Oromiya is reported to have just set up a sugar factory. Both these companies are relatively small compared to existing and planned government sugar farms.

Other possible sources for ethanol production in Ethiopia include sweet sorghum, beetroot, sweet potato, and prickly cactus fruit which are cultivated by smallholder farmers. Sorghum is cultivated in many parts of Ethiopia including Amhara, Oromiya and SNNP. Sweet sorghum has very good overall benefits with the advantage of providing food, fuel and animal feed; it has low requirements for water and for fertilizer. Beetroot and sweet potato are also very good feedstock for ethanol production and in many ways better suited for small scale ethanol production compared to sugar cane or sweet sorghum.⁸

Table 3.2 Productivity and cost of ethanol production from sugar cane and sweet sorghum

Crop	Cost of cultivation (US\$/ha)	Crop duration (months)	Fertilizer requirement (N-P-K kg/ha)	Water requirement (m3)	Ethanol productivity (Liters/ha)	Average stalk yield (t/ha)	Per day productivity (kg/ha)	Cost of ethanol production (US\$/ha)
Sweet sorghum	435 over two crops	4	80-50-40	8000 over two crops	4000/y over two crops	50	416	0.32
Sugar cane	1079 per crop	12-16	250/400-125-125	36000 per crop	6500 per crop	75	205	
Sugar cane molasses					850 per year			0.37

Source: Reddy, Belum VS, et.al (?). Sweet sorghum as a biofuel crop: Where are we now, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

Beetroot and sweet potato are produced mainly by smallholder farmers. The area cultivated was 1,795ha and 41,634 ha for beetroot and sweet potato respectively in 2012/13 (Table 2.3). In 2012/13 production for beetroot was 16,848 tons and for sweet potato was nearly 1.2 million tons. The major sweet potato growing zones in Ethiopia are (East Hararge in Oromiya, Wolayita and Sidama in SNNP).

Prickly cactus fruit grows wild in Ethiopia and until very recently had little market value. It is now sold in the market as fruit. Alcohol can be produced from cactus juice and this has been recognized by a private company that has plans to produce potable alcohol from the juice. This is a potential new source for alcohol because of its high productivity and its relatively low market value. Cactus also requires very low input levels (water, fertilizer).

Existing ethanol production feedstock is limited to molasses from the sugar refining process. Molasses will continue to be the main feedstock for production of ethanol from state owned sugar factories. The Sugar Corporation plans to promote private investment in ethanol plants for selected state owned sugar refineries that will start operation in the near future. Small volumes of molasses

⁸ John Loke and Endalkchew Mekonnen, 2014. Holistic Feasibility Study of a National Scale-up Program for Ethanol Cook stoves and Ethanol Micro Distilleries (EMDs) in Ethiopia, Part: EMDs.

will be available in the short term that may be used for ethanol production by micro distilleries (pilot plants are now under development).

The summary of feedstock type, their current production levels and suitability for ethanol production is provided in the following table.

Feedstock	Feedstock production	Ethanol distillery	Policy support	Suitability for EMD
Sugarcane	Commercial, smallholder	Micro, small, large	Questionable	Low
Sugarcane molasses	Commercial	Micro, small, large	Yes	High
Sweet sorghum	Smallholder	Micro, small	Yes	Low
Beetroot	Smallholder	Micro	Questionable	High
Sweet potato	smallholder	Micro	Questionable	High
Prickly cactus fruit	Wild, smallholder	Micro	Yes	High

3.1.2 Ethanol production

Production from the public sector

Ethiopia produced 14.6 million liters of fuel grade ethanol in 2012/13 from sugarcane molasses from two state owned sugar enterprises (Finchaa and Metahara). The government plans to expand ethanol production by converting all (or most) of the molasses available from existing and planned sugar factories. Several sugar estates are already under development and the plan is to increase ethanol output to 135 million liters within five years from nine sugar factories. Ethanol production from the existing ethanol producers will rise to 32 million liters while new ethanol plants will contribute 102 million liters.

Production of ethanol from these new and larger sugar factories will increase ethanol availability. Availability of ethanol for cooking will depend on ethanol requirement for transport (the priority for the government at present) which in turn depends on growth of demand for gasoline. The benefits and costs of using ethanol for transport versus cooking must be clearly shown to policy makers to ensure larger and continuous supply of ethanol.

Potential production from the private sector

The Ethiopian Sugar Corporation state that they welcome private investment in ethanol production from molasses (and other waste such as sugarcane off-cuts) from selected public sugar factories in the future (Wonji was mentioned, and possibly Tendaho and Kesem according to a 2011 plan). They may welcome early discussions with potential investors to install ethanol refineries for selected state owned sugar factories.

Local private companies are also interested to invest in ethanol distilleries using molasses from state sugar factories as feedstock. A consortium of companies that included Yetebaberut Petroleum was in the process of raising capital to make such an investment. According to the management of Yetebaberut the effort was abandoned because the consortium could not raise the required capital.

Two private enterprises, one foreign and one local, are in the initial states of sugarcane development as outline in the previous section. Although these are relatively small companies with much smaller production capability than state farms they may provide ethanol at competitive prices for cooking (in contrast to government sugar factories where supply and prices appear not to be market based). These may become dedicated suppliers of ethanol for cooking.

Ethanol production with micro distilleries is possible using several of the alternative feedstock described in the previous section (sugarcane, sugarcane molasses, root crops, cactus, fruit and vegetable waste). The suitability of the alternative feedstock for ethanol production is discussed in the EMD evaluation report (*John Loke and Endalkachew Mekonnen*). Feedstocks that are considered to have high potential include sweet potato and beetroot.

Availability of ethanol for cooking will increase for cooking in the near future. The main sources will be:

- Increased production of ethanol from the government sugar factories: production is likely to increase significantly in the near future although government plans have been delayed;
 - Increasing processing capacity, efficiency (are existing factories using the best available technology to produce ethanol? Can output be increased in any way from the same type and volume of sources? Can additional wastes be used (e.g. cane tops) to increase feedstock then output?)
 - Potential to operate existing and forthcoming sugar factories to produce sugar and ethanol in flexible proportions depending on relative prices of sugar and ethanol (this may boost ethanol production)
- Increased allocation of ethanol for cooking from government ethanol producers: government states that they will increase allocation if distributors can guarantee uptake (distributors, on the other hand, complain that supply is not certain or prices stable);
- Introduction of production of ethanol from the commercial private sector: these will be small scale ethanol producers but may be sustainable and stable sources of ethanol for cooking;
- Introduction of ethanol production in micro distilleries (diversify feedstock for ethanol production, molasses to fruit waste): this option is at the trial stage where several units are under development. Key issues for EMDs are sufficient availability of feedstock at competitive prices for ethanol production (feedstock price, production cost, market price).

3.1.3 Ethanol distribution

Ethanol for cooking is distributed by two local private companies in Addis Ababa. Two other institutions, Gaia Association and UNHCR, also distribute ethanol for cooking in refugee camps. The two private companies sell ethanol stoves as well as distribute ethanol: the two sold about 100,000 liter of ethanol in 2013/14 (2006EFY). The two private companies also distribute ethanol cook stoves.

The ethanol distributors receive ethanol from the government ethanol producers Fincha and Metehara. Ethanol supply for cooking was uncertain in the recent past but this appears to have been resolved with the allocation of a relatively large amount of ethanol in 2006 EFF (2013/14). Suppliers of ethanol for the cooking market were able to purchase less than 20% of the allocated amount. The private companies point to the low level of market development as the main reason for not distributing as they plan.

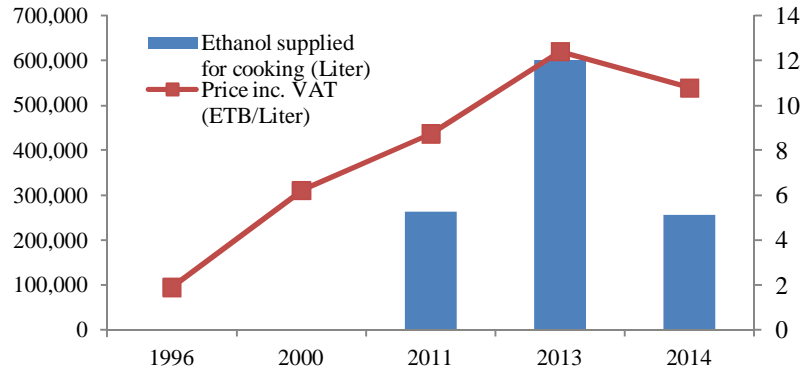
Ethanol distribution is made by the two private companies from single storage and distribution points in Addis Ababa. Ethanol is stored in plastic tanks and distributed using 5L, 10L, and 20L plastic cans brought in by customers. The storage and distribution sites are located in residential areas and housed in basic facilities (without any special fuel handling mechanisms).

Distributors of ethanol purchase ethanol from the sugar factories for Birr 10.78/liter and retail it to consumers at Birr 13.99/liter. The Birr 3/liter margin covers transport, storage and distribution costs in addition to distributors' margin. Purchase price for ethanol has more than doubled in the past five years (the reason provided by the Sugar Corporation is labor and other costs have risen). This rise in supplier prices is one of the reasons that the distributors indicate as one barrier to expanding the market for ethanol as cooking fuel. Higher purchase prices also mean distributors require proportionally higher working capital to purchase the fuel and the longer period they require clearing their purchases (because of higher consumer prices).

Local petroleum companies have shown interest in the ethanol distribution business; their main concern is on market size and stability of supply and margins. NOC and Yeteberet Petroleum were interviewed for this assessment; they both indicate they will be willing to make the required

investment in modification (or installation) of ethanol distribution facilities if and when there is large enough to warrant such investment.

Figure 3.1 Ethanol fuel supply for cooking and price trends, 1996-2014



Source: Ethiopian Sugar Corporation

Figure 3.2 Ethanol storage and distribution for cooking



The MOWIE has trained a group of MSEs to produce the ethanol stove it developed (adopted from the Dometic CleanCook stove). These MSEs are also expected to distribute ethanol fuel to consumers (the same distribution model as Makobu and Moges).

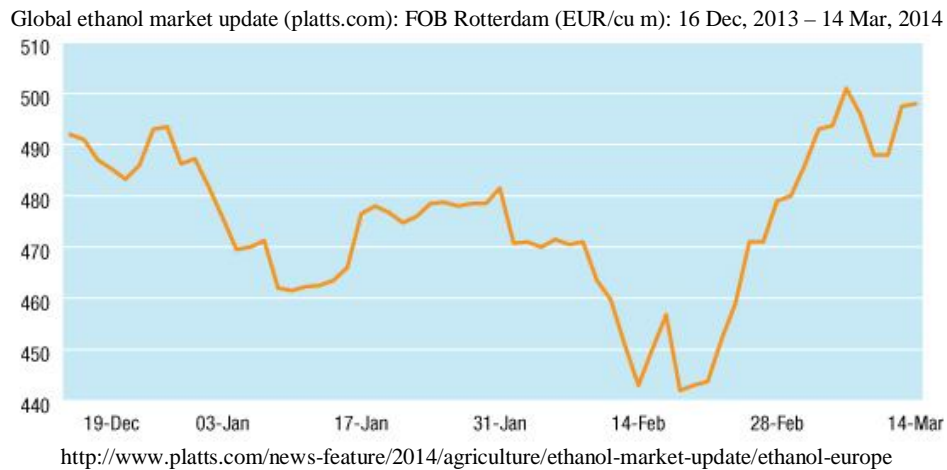
The government (Sugar Corporation) is also contemplating exporting ethanol in the short term. There is some doubt whether local demand will absorb what is produced. There is also expectation of higher prices and revenue from exports. However, simple evaluation of prices for export and domestic use shows that domestic use is much more attractive to ethanol producers. An example illustrates this:

- International price for ethanol in Europe (Rotterdam in the Netherlands, shown below) is €0.5/liter (ETB 13/liter).
- Transport cost from Ethiopia to an international market such as the EU will be significant (say ETB 3/liter).

- Factory gate price for ethanol produced in Ethiopia will then be only ETB 10/liter.
- Compare this to ETB 13/liter that ethanol is sold today for the domestic market.

Domestic use of ethanol is preferred in terms of foreign exchange gain (or saving). Ethanol replaces imported kerosene which is sold in Addis Ababa at a subsidized price of ETB 15.95/liter (ETB 18 if not subsidized).

Figure 3.3 Ethanol price in Europe, Dec 2013 – Mar 2014



The following issues have been raised by ethanol distributors and observed during consultations with them:

- Availability of ethanol for cooking has not been stable, compromising the market development effort of the distributors because new customers cannot be sought when supply cannot be guaranteed.
- Ethanol supply price to the distributors has doubled since 2000 and this has raised the retail price for consumers proportionally; suppliers feel this has been detrimental for market development for ethanol.
 - There appears to be no transparent price build up for the factory gate price (and then for transport and distribution costs and margins for ethanol). There are questions about the competitive pricing of ethanol for distributors.
 - Ethanol must be competitively priced with its alternatives (e.g. kerosene, charcoal, LPG and electricity); without such competitive pricing the market for ethanol will remain insignificant and the benefits (social, economic, and environment) foreseen for it will not be realized.
- Ethanol storage and distribution infrastructure used by ethanol fuel distributors for cooking at present may not fulfill the safety and environmental conditions that may be applicable for ethanol.
- Petroleum distribution companies are interested in ethanol distribution for cooking. They consider the distribution margins for ethanol are much higher than for other petroleum products. They say they will invest in storage and distribution and will also promote the fuel as long as supply is guaranteed at stable prices.

3.1.4 Ethanol consumers

Ethanol is used as cooking fuel by about 3,000 households in Addis Ababa. About three-quarter of the households use the CleanCook stove imported and supplied by Makobu, the rest use the locally produced stove by a local manufacturer. There are no commercial or institutional consumers of ethanol for cooking so far.

Ethanol is in competition with electricity, kerosene, LPG and charcoal in the major markets. Recent price rises for ethanol has eroded the competitiveness of ethanol against the alternatives (although prices have also risen for the other fuels other than electricity). The price rise for ethanol may have reduced its use as the main cooking fuel in many households (households now use ethanol as a backup fuel during power blackouts in the city).

The locally produced single burner ethanol stoves are sold for Birr 385 and the one imported for Birr 1,340. Price for the imported ethanol stove has risen by 35% over the past three years (was Birr 980). This has also reduced consumer demand for ethanol as cooking fuel.

Consumers seek reliable (continuous) supply at competitive and stable prices for both the fuel and the stove. However, prices have been growing for both fuel and stove while supply has been unreliable. This and inadequate market development action by the government and others concerned have stalled the market penetration of ethanol.

3.3 Chain support institutions and activities

Support activities in the ethanol supply chain include research and development, inputs supply, finance, and policies and regulations. R&D is carried out in the areas of feedstock production, industrial production and energy. Inputs supply includes inputs to feedstock production (seed, fertilizer, mechanization, irrigation) and industries (EMDs, stoves). Financing is required for all actors across the supply chain for investment and operations. Policies and regulations are the framework under which all actors operate (discussed in the next section).

Research and development (R&D)

R&D on sugar cane is carried out by the Research Directorate under the Ethiopian Sugar Corporation. Research on sugar cane is focused on improving productivity through improved management (soil management, inputs, and protection) in state owned farms. Sugar cane yield in Ethiopia is among the highest in the world at 144t/ha (Table 3.1); Ethiopia ranks third globally in sugar cane yield (productivity) after the Philippines and Peru (FAO).^{9,10}

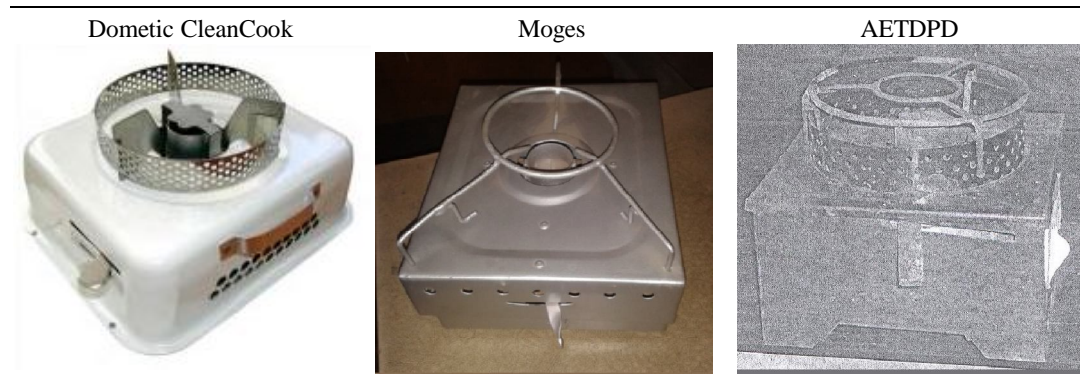
R&D for industrial products and process (ethanol, distillery equipment, stoves) is carried out by METEC through its factory, *Hibret Manufacturing and Machine Building Industry* (HMMBI). Hibret currently provides parts for existing state sugar factories; it has plans to provide equipment for newly established sugar factories in Ethiopia. METEC has capacity to manufacture main equipment components for sugar and ethanol processing as well as for ethanol stoves. METEC focus is on manufacture and supply of equipment for the new large state owned sugar factories.

⁹ <http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/E>

¹⁰ “It is a common belief that the significant production growth that occurred in Brazil since the 1990s was linked to a massive investment in technology both at the farm level - in terms of the adoption of high performing sugarcane clones - and at the factory level, with the conversion of sugarcane into ethanol.” Increased productivity rather than increased land under cultivation is responsible for rise in output at the global level (major sugar producing countries have raised productivity by 0.98% annually). Amrouk, El Mamoun, et.al., 2013. Structural Changes in the Sugar Market and Implications for Sugarcane Smallholders in Developing Countries: Country case studies for Ethiopia and Tanzania (FAO).

R&D for ethanol stoves is made by the government at the MOWIE (AETDPD) and by the private ethanol fuel and stove supplier Moges. These have focused on adopting the stove originally made by Orego (later Dometic) which uses fiber enclosed in canister (into which ethanol fuel is stored) to transport fuel for combustion.

Figure 3.4 Ethanol cook stove in the market in Ethiopia



Inputs supply

Private enterprises are the main suppliers of inputs (stoves and EMDs) for ethanol use for cooking. Ethanol cook stoves are manufactured and supplied by one small scale private enterprise (Moges) and imported by another (Makobu). The AETDPD has trained micro enterprises to produce its version of the ethanol stove. According to the EMD study by this project local manufacture of some EMD components is feasible.

Ethanol micro distillery equipment supply

The EMD study team for this project has evaluated feedstock and technology for EMD application in Ethiopia. The team has also evaluated local manufacturing and supply capacity for EMDs. The evaluation recommends molasses and sweet potato (other recommendations include cassava, sugar beet, yam, taro, prickly pear cactus, mango) as the most suitable feedstock for EMDs.

Production of ethanol from sugar cane or sweet sorghum is recommended usually; the recommendation from the EMD team is that sugar cane will be a more expensive ethanol production alternative considering its high demand for water, its availability only for certain months of the year, its contribution to climate change (burning of leaves during harvest), its loss in quality in long storage, possibly lower productivity compared to sweet potato, and its low food value compared to sweet potato.

The evaluation also indicates that from the point of the ethanol producers as well sweet potato has several advantages: lower transport cost because it can be dried before transport, energy needs are lower compared to ethanol from sugar cane, and the processing equipment is also much cheaper (up to 20 times cheaper). Safety, profitability, suitability of ethanol produced as cooking fuel, ease of operation, scalability, continuous operatability, multiple feedstock use, local production possibilities for equipment, efficient resource use (water, energy) all make sweet potato a better feedstock for production of ethanol than sugarcane.

According to the assessment of the EMD technical team **only a limited number of components** of the EMD to process sweet potato (and sugar cane molasses) to ethanol can be manufactured locally. Components and services that can be manufactured or supplied locally include general infrastructure (utilities, PE tank storage) and equipment for preparation and storage of raw materials (PE tanks, submersible pumps, and hammer mills).

Components of the EMD that need to be imported include the following:

- Fuel based generators, air compressors
- Monitoring equipment (scales, refractometer, digital thermometers, lab distillation equipment, combustion analyzer, pressure gauges, alcohol meter)
- Reception and storage (gear pumps with accessories)
- Preparation of raw materials (submersible pumps, portable chippers, hammer mills, engines for operation of mills, chemicals for pre-processing,
- Chemicals for ethanol processing (yeast multiplication chemicals)
- Equipment for fermentation (electric agitators, heat exchangers, automatic temperature actuated modulating valves)
- Preheating equipment (copper tubes, stainless steel pipes, insulation)
- Drying of biomass and steam generation (ovens/boilers/steam generators)
- Distillation equipment (thermal insulated rectification column (stainless steel), automated temperature management system, heat exchangers, condensers, decanters)

The EMD team visited and consulted six metal manufacturing factories in Addis Ababa (both government and private enterprises: Akaki Basic Metals Industry, Amio, Hibret, Selam, Sintec, and Vonall). The finding is that these enterprises can manufacture chippers, hammer mills, they can also do metal forming of metal laminates, bars, angles and pipes (welding, cutting, rolling, bending, perforation). Local companies can also supply EMD workshop construction and materials (motors, metal sheets, metal profiles, angles, pipes, bars), stainless steel laminates, tanks (PE), and PVC tubes.

Investment cost in EMD facilities range from US\$53,000 (150LPD) to US\$452,000 (3200LPD). EMD equipment accounts for 40% of the total investment. Equipment costs and their transport account for 65% to 75% of the investment cost. Professional costs (direct labour, EMD experts) account for about 15-20% of the investment, supplies and other costs account for about 5% of total investment.

The evaluation recommends a business driven approach to EMD technology transfer where small, complete low-cost but safe systems are introduced initially. They also recommend using feedstocks that do not compete with food production and enterprises; to provide support for licensing, financing and training of micro distilleries.

Financing

Enterprise financing is sourced from commercial, development and microfinance banks. Small and medium scale enterprises depend on commercial and development banks while MSEs are financed by MFIs. Business financing is a major constraint for small and large enterprises alike. MSEs in particular have very limited internal resources to start and operate their businesses.

Renewable energy financing, except for short term loans for product imports, is very limited in Ethiopia. The special characteristics of renewable energy enterprises are not understood by commercial, development and micro finance banks which restrains them from provision of loans to RET enterprises.

The specific constraints of renewable energy financing is now better understood and specific enterprise financing models, loan guarantee schemes, and risk sharing mechanisms are now employed in Ethiopia including:

- Allocation of funds dedicated to renewable energy enterprises including foreign currency for imports;
- Financing through micro-financing banks mainly for RET enterprises but now also for consumers;

- Risk sharing with banks where collateral requirements from loan recipients is lowered with funding from donors; and
- Guarantee funds where loan default risk is covered by donor funds.

MOWIE with support from the World Bank is now providing RET specific financing through the Scaling-up Renewable Energy Program (SREP) fund through the Development Bank of Ethiopia (DBE). The SREP fund is allocated for financing of enterprises (micro to large) and consumers. The SREP fund is available at concessional interest rates (6%) for short term capital (for example purchase of solar systems for distribution in the country) and for investment in manufacturing and services.

The SREP fund may be applicable for ethanol businesses including manufacture of stoves and distribution of ethanol fuel.

4. Barriers for actors in the ethanol value chain

4.1 Non financial barriers

4.1.1 Feedstock production

In Ethiopia ethanol is produced from the sugar processing waste molasses. Increasing productivity of sugar cane production will have a direct impact in increasing potential ethanol output from sugar producers. Medium and large scale production of sugar cane is dominated by state farms and out growers that supply cane to government sugar factories. Cane productivity from large farms is relatively higher than for small holder farms but still much lower than productivity for large farms in major cane producers such as Brazil. Cane processing may also be less efficient in Ethiopia (particularly for the old sugar factories) compared to international benchmarks.

Government owned sugar factories dominate sugar supply and this dominance is expected to increase when the ambitious government plan for the sector is realized. The government will continue to be the price maker for the sector because of its size in production and but also because imports are regulated by it; government set prices for sugar may make private investment in large scale private sugar production unviable.

Ethanol production from feedstock other than sugar process waste has not been give sufficient attention in Ethiopia. The biofuel strategy also does not provide clear indication on whether feedstock production for the sole purpose of ethanol production is possible (this is possible for oil crops that may be used for biodiesel production).

- Low productivity – low productivity lowers the potential ethanol production from sugar factories;
- Local price regulation by the government – smaller private sector producers may be unable to supply sugar at prices set by the government (cost of production is higher for private producers because their smaller size, higher cost of capital and higher cost of land);
- Unclear policies for production of ethanol from sugar cane or other feedstock directly.

Major smallholder sugar cane production zones include Sidama and Wolayita in SNNP. Sufficient cane is available in the major cane production zones to run ethanol micro distilleries; the challenge is getting resources at competitive prices because cane is now sold at relatively high prices for chewing.

Fruits and vegetables are another potential source for ethanol production. Major fruit and vegetable production areas will be candidates for ethanol production including fruit and vegetable packers in the Awash area and major smallholder fruit production areas such as Arba Minch.

- Low productivity of farms, low availability of waste, low collection of waste
- Relatively low density of fruit production in most such “large” scale farms – the waste available in a typical site will not sustain more than a few EMDs

Other potential feedstock for ethanol production include sweet sorghum and cactus (Beles). The potential of sweet sorghum to provide both ethanol (fuel) and grain (feed) is under trial at ICRISAT¹¹ which promotes the crop for ethanol and grain production (stating that cost of ethanol production from sweet sorghum is lower than that from sugar cane molasses and at the same time it provides additional grain of 4 to 6ton/ha). Cactus is another new potential source for ethanol production in Ethiopia (grows wild).

4.1.2 Ethanol producers

Two sugar factories (Fincha and Metehara) now produce ethanol from sugar cane molasses. Ethanol production is expected to increase when the new sugar factories start ethanol production. There are no

¹¹ International Crops Research Institute for the Semi-Arid Tropis

private companies producing ethanol in Ethiopia. However, the government plans to invite private investment in ethanol production from molasses waste from selected new government owned sugar factories. A consortium of local companies did initiate a plan to invest in ethanol production but have failed to raise the required capital (discussed under financing barriers). Both local and international companies are interested to invest in ethanol production from molasses waste from government sugar factories and other sources provided that

- Policies and regulations are clear about production of ethanol from feedstock other than waste (e.g. from sugar cane, sweet sorghum)
- Prices for ethanol must be viable for producers – price regulation by the government balance producer and consumer benefits
- Market development – the only producer in Ethiopia, the Sugar Corporation, points to the need for alternative market development for ethanol including cooking to absorb increased production. Private sector producers will also need such market development before they invest in ethanol production

4.1.3 Ethanol fuel distributors

Ethanol for cooking is distributed by two private companies (Makobu and Moges). Distribution of ethanol for cooking has not increased as expected either by the government or the distributors. Although the government (Sugar Corporation) has allocated up to 2 million liters of ethanol for cooking for 2006 EFY the distributors could purchase less than a tenth of this. Petroleum distributors (NOC, Yetebaberut) are also interested in distribution of ethanol for cooking. The major issues raised by existing and potential distributors include

- Market development – the market for cooking fuel is yet to be developed. The market is small and possibly shrinking (due to the mass switch to electric cooking in urban areas) and the market for existing distributors is shrinking. The market size today is also not large enough for the large petroleum distributors to invest in distribution infrastructure.
- Uncertainty of ethanol supply for cooking – there has been uncertainty of ethanol allocation for cooking in past (this has been addressed recently).
- Uncertainty of price for ethanol from government factories– distributors seek price stability for ethanol (to develop the market); they also seek competitive pricing of ethanol with alternative fuels (kerosene and LPG).
- Low technical and financial capacity of existing ethanol distributors - The existing ethanol distributors have relatively low distribution capacity (technically in distribution facilities and also in financing purchases).
- Standards for ethanol fuel storage and distribution – these do not exist at present (and the Petroleum Distribution Regulator indicates the possibility of instituting/adopting appropriate standards). Existing ethanol distribution facilities may not meet strict fuel storage standards; distributors will need support to invest in improved storage and distribution (including land, technical support, and financing).

4.1.4 Ethanol stove suppliers

Ethanol cooking stoves are supplied by Makobu (imported) and Moges (locally produced). The AETDPD has adopted the CleanCook stove and has trained MSEs for production of the stove, these have, however, not produced any stoves so far. Total ethanol stove sales by Makobu and Moges are fewer than 2,500 units. The proportion of ethanol stoves now in use will also be significantly lower than this (probably 1,500 units) for reasons including switch to electricity, damage to stoves and fuel availability.

- Market development – the ethanol stove suppliers had/have plans to invest in manufacturing and import of stoves. However, they all see the market today as too small and that they will need market development support before/while they make the investment.

- Inputs for manufacturing –stove suppliers need land and financing to invest in manufacturing (Moges has received land for this purpose and plans to seek financing from commercial banks); MSEs in particular will need land, technical and business training, and financing
- Standards and quality – there are no standards for stoves (including ethanol stoves) in Ethiopia. These are required to get the economic, environmental and health benefits from ethanol stoves. Both imported and locally produced stoves must meet such standards before they are disseminated.
- Ethanol stove prices – are high for imports but relatively low for locally produced stoves. Meeting standards for high quality may raise the price of stoves.

4.1.5 Ethanol micro distillery equipment manufacture

Discussions and visits of several potential manufacturers (by the EMD technical team) have indicated the technical feasibility of manufacturing micro and small ethanol distillery equipment in Ethiopia. However, again market size and cost of production inputs (materials, personnel, finance) determines financial feasibility.

4.2 Financial barriers

4.2.1 Feedstock production

The government is the only large scale sugar producer in Ethiopia. Private sector investment in sugar production was initiated by one local (Hiber) and one foreign companies (an Indian company in East Wellega) in the past few years. The local company is now supplying cane for a government sugar factory as an out-grower, Al Habesha is transferred the land it acquired for cane cultivation to the government owned Sugar Corporation, and the new Indian company (which is considered small) has just started its operations but it is yet to establish its sugar processing factory.

Capital for sugar processing appears to be a problem for both local and foreign companies. The company failed to raise the required capital and has opted to start operations by supplying cane to a government factory; the foreign companies appear to have the same problem.

4.2.2 Ethanol production

Capital requirements for medium and large scale ethanol distilleries are high and difficult to raise locally. Recently a group of local companies initiated a plan to invest in ethanol plants for the new sugar factories (including Yetebaberut) but they were unable to raise adequate capital. Uncertainty about market availability for ethanol (for the gasoline-ethanol blend mandate, cooking and other applications) further inhibits private investment in large ethanol plants.

4.2.3 Ethanol distribution for cooking

Ethanol distributors require short term capital for ethanol fuel purchases from the sugar factories. They have not faced significant constraints so far because they have only been able to distribute a small proportion of what they plan to distribute (less than 100,000 liters annually whereas the allocation was for 2 million liters annually). They expect to increase supply with market development; they would then need short term capital for fuel purchase.

Ethanol fuel distributors will also need to invest in proper distribution facilities to meet fuel distribution regulations that may be enforced for ethanol in the future. Existing petroleum fuel distributors may get into ethanol distribution if the market is available and margins are attractive.

- New Draft Energy Policy (2013): Lack of distribution system for ethanol use in the domestic sector: Ethanol could be used for household cooking through replacing kerosene. The use of ethanol in households faces two major constraints: relatively high cost of ethanol stoves compared with kerosene stoves. Furthermore, there is no network infrastructure in place for storage and supply of ethanol for domestic use throughout the country.

4.2.4 Ethanol stove and EMD supply

Presently ethanol cook stoves are supplied by ethanol fuel distributors. Makobu is supplying the imported Dometic CleanCook stove; Moges manufactures and supplies its own stove. In addition, AETDPD trained MSEs are expected to provide ethanol stoves in the future. Makobu and Moges have plans to invest for large scale production (and assembly) of ethanol stoves in Addis Ababa.

Makobu and Moges plan to produce (or assemble) the stove in medium scale manufacturing facilities with loan financing from commercial banks or the DBE. Moges has indicated that he can secure loan for investment in his new ethanol stove plant from commercial banks (has prior business with a commercial bank). Collateral requirements will be the main issue for loans from either commercial banks or the DBE.

4.2.5 Consumers

Consumers are not expected to seek financing for ethanol stove purchases (locally manufactured stoves are now sold for Birr 400 and less). Ethanol is expected to be mainly used in urban areas by households and institutions and these can make stove purchases without financing.

Financing

The DBE is administering two RET related funds, one specifically for off-grid Rural Electrification and the other for all RETs (the SREP fund). The SREP fund may be accessible by enterprises and consumers for ethanol; this fund is available to enterprises and to MFIs for on-lending to MSEs and consumers. However, disbursement from the SREP fund has been very slow. Two main reasons are given for this:

- a. High collateral requirements from the DBE (125% of the loan amount), and
- b. High risk of default, particularly for on lending to MFIs.

Commercial banks are the main source of finance for ethanol fuel distributors for short-term capital. Existing ethanol distributors indicate that they will be able to access short-term capital financing from commercial banks.

- a. Commercial banks have high collateral requirements,
- b. Financing may be limited for long term investments, and
- c. Interest rates are relatively high (compared with the DBE).

MFIs are the principal sources of financing for MSEs and consumers. Loans for business start-up and later for expansion for MSEs producing ethanol stoves (who may also distribute ethanol fuel according to the MSE support office at the MOWIE) will be mainly from MFIs.

- a. Mandatory saving is required for enterprises seeking loans from MFIs (usually 20% of the loan amount before loan is disbursed). New enterprises may find it difficult to provide this amount of saving,
- b. Typical sizes of loans are small and may not be adequate for ethanol stove producers (although they are growing and in special cases they provide loans as much as Birr 250,000),
- c. Interest rates are high (typically above 15%).

5. Recommendations for private sector development

5.1 Non financial actions

The key non-financial issues for the private sector in the ethanol supply chain are first expanding the market for ethanol so they will have sufficient business, then upgrading their technical (and for MSEs their business as well) skill gaps so that they can address market demand including quality standards.

- a. Market development support to ethanol fuel producers, distributors and equipment suppliers. Ethanol distributors require increasing allocation of ethanol for cooking purposes although they have not taken up what was allocated in recent years. New distributors of ethanol should also be sought including the MSEs trained by AETDPD to produce ethanol stoves.

Competitive pricing of ethanol to kerosene (and other competing fuels) – ethanol will be widely used only when it is competitively priced with other cooking fuels. Ethanol supply price to distributors should be low enough and stable so that the distributors can deliver ethanol to consumers at competitive prices to alternative fuels. Distributors must also have sufficient margins on fuel delivered to sustain their business.

Public information to increase market for ethanol as cooking fuel, primarily in urban areas and for households. Once sufficient supply of ethanol is available at competitive prices the public should be made aware of the option of cooking with ethanol. Distributors can then building on this public information campaign to promote the fuel and their stoves in selected areas.

- b. Technical support for stove and EMD equipment producers. Both Makobu and Moges are in the initial stages of setting up their small (medium) scale stove manufacturing plants (in the case of Moges he is in the process of importing manufacturing equipment). There are also micro and small enterprises (MSEs) that are trained to manufacture ethanol stoves by the AETDPD that may engage in stove production business.

Government support for MSEs in provision of work space at low rent, facilitation of financing and training has helped stove businesses including ethanol stove businesses.¹² This support serves as business incubation, a good approach from regional governments to promote micro and small enterprises.

- Technical and business training for MSE stove producers need to be strengthened for MSEs.
 - Development or adoption of better value ethanol stoves (either in lower costs or better performance) should also be given attention. Stove development grants can be provided for this purpose to universities, enterprises and individuals.
- c. Standards for ethanol storage, distribution, and stoves. Standards are required to ensure technical as well as environmental, safety and health benefits are realized. Standards for stoves are in the initial stages of development; these standards are expected to cover ethanol stoves as well. Standards for storage and distribution of ethanol fuel may also be implemented in the short term. First companies need to be consulted and informed of the new standards, then they should be provided with technical support to meet these standards
 - Local manufacturers of ethanol stoves may need to upgrade their design quality and also manufacturing capabilities to meet standards. Technical support can be provided to stove manufacturers, particularly MSEs to meet these standards.

¹²MSEs receive low-rent workspace, technical and business training and financing (from regional MFIs) to start and grow their businesses. This type of support has helped Moges, for instance, to continue operation while he was developing his investment plan.

- Ethanol storage and distribution may require storage and distribution standards similar to petroleum. Current distributors of ethanol for cooking may not meet such standards; they will need to have access suitable sites and equipment for distribution.
- Lack of distribution system for ethanol use in the domestic sector: Ethanol could be used for household cooking through replacing kerosene. The use of ethanol in households faces two major constraints: relatively high cost of ethanol stoves compared with kerosene stoves. Furthermore, there is no network infrastructure in place for storage and supply of ethanol for domestic use throughout the country.

5.2 Financial support

Financing is recognized to be a major barrier for increasing energy services in Ethiopia. The Draft Energy Policy (February 2013) highlights this constraint:

The energy sector is highly capital intensive sector in the country, requiring substantial investment and for promoting the transition from traditional solid biomass fuels to modern energy services. While, a large share of government investment is directed to the energy sector, more investment is required, from diversified sources including the private sector, to get the energy sector at the level of development needed to support all economic and household sectors.

The policy recommends provision of incentives for the private sector to increase its engagement:

Attract domestic and foreign investments in energy services provision through providing appropriate fiscal and tariff-based incentives.

The government has invited private investment in the bio-fuels sector. The government seeks private investment in ethanol production from molasses waste from government the new sugar factories. Domestic private companies have shown interest to make such investment but have limited for the investment required. Foreign companies will be interested to make such investment if prices and margins are attractive. If EMDs turn out to be feasible options for production of ethanol investors will also need capital for this purpose.

- a. Provide loans for investment to large and small ethanol distillery enterprises. Investment capital for all sizes of ethanol distilleries are required which the DBE may provide. It is noted that the Biofuels Strategy recommended/promised such financing.
- b. Open the possibility of foreign investment in large scale ethanol distilleries. Local companies may also go into consortium with foreign companies to raise the capital required but foreign company investment will depend on the level of demand, stability of prices and margins.
- c. Local companies have limitations to meet equity requirements of banks (30% usually); this hurdle may be lowered to attract investment in the sector. Again note is made that special incentives be provided for biofuel investment which may be realized through such lowering of equity requirements.
- d. Loan security (collateral) requirements for investment ethanol distilleries and stove manufacturing may be lowered to attract enterprises into the sector. Such investment guarantees are available from new renewable energy interventions (e.g. the GEF/UNDP): these new projects seek to lower the investment barrier to the enterprises by providing part of the collateral to selected projects.

5.3 Policies and regulations

Limited private sector participation is recognized as a major issue for the further development of the energy sector in Ethiopia (Draft Energy Policy, 2013). The policy promises to provide favorable environment for the private sector, in technical and fiscal incentives, to increase its engagement in the sector. The Ethiopian Biofuels Development and Utilization Strategy (2007) promised similar support

for the private sector. Some of the policy support that the government can provide to private enterprises include the following.

The Biofuels Development and Utilization Strategy promotes alternative feedstock for biofuel production. However, clear direction is not provided on whether production of ethanol from agricultural crops (sugar cane, sweet sorghum, other crops) is supported. Land has been provided for production of oil crops for biofuel production; similar allocation of land for crops that yield ethanol do not appear to be supported. The policy needs to give clear direction on the support of cultivating crops and processing crops directly for the production of ethanol.

It is recommended that the government allocate sufficient and growing amount of ethanol fuel for cooking. Stable supply is required for sustained development of the market (consumers want to know that fuel will continue to be available at competitive prices to alternatives). Uncertainty in the availability and pricing of ethanol for cooking inhibits market development.

Consumer price for ethanol must be competitive with alternatives in the market. Otherwise the market will continue to be too small to have any significant impact (in financial benefits to the consumer, environment benefits and economic gains to the country in general). This implies attractive wholesale prices and sufficient profit margins to the distributors.

Standards may soon be introduced for ethanol storage, distribution and stoves. Standards for stoves are being developed (may include ethanol stoves); standards for storage and distribution may also be introduced soon. The government needs to invite private companies in this standard setting exercise and then support them technically meet the standards (for example, provide land for ethanol storage and distribution, training for stove producers).

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Annex

Annex A1. Checklist for discussion with stakeholders

Date: _____

Name of institution: Ethanol producers (large, small, micro), ethanol fuel distributors, stove producers and distributors, micro distillery equipment manufacturers (potential), banks, government

Consulted employee(s) and position: _____

Key questions for stakeholders

- a. Engagement in ethanol feedstock production, ethanol production and distribution (fuel, device), use
- b. Issues/challenges/barriers for business, access to finance, market information
- c. Business development services required to address barriers
- d. Other recommendations to address barriers
- e. Specific financing and other business development support required
- f. Relevant policies and regulations (for those that deal with policies and regulations)

Questions	Answers
1. Enterprise/organization mission	
2. Enterprise/organization objectives for ethanol	
3. Enterprise/organization activities for ethanol, plans What activities, where, when, how many, who with, other?	
4. Enterprise/organization view of the potential of ethanol as cooking fuel in Ethiopia Current market, potential market, competitiveness	
5. Issue/challenges for your enterprise/organization <ul style="list-style-type: none"> ▪ Market, demand ▪ Supply of inputs ▪ Financing ▪ Technical, managerial capacity ▪ Technical issues ▪ Regulations, policies ▪ other 	

6. Recommendations to address your challenges	
<p>Specific requirements of your enterprise/organization</p> <ul style="list-style-type: none"> ▪ Financing (type, amount) ▪ Market information ▪ Demand development ▪ Quality ▪ Technical capacity building ▪ Business training 	
7. Issue/challenges in the ethanol supply chain in general	
8. Recommendations to address in the ethanol supply chain in general	
9. Other issues that the enterprise/organizations wants to raise?	

Annex A2. The ethanol value chain: actors, supporters, enablers

Chain	Description	Enterprises/actors	Support organizations	Macro enablers
Production/input	sugar cane farms, sugar waste producers	Fincha, Metahara, other public, private farms, small holders	MOA, Reg Ag Bur, banks, Ag input providers	Agri. policy, env. policy
Processing	Ethanol producers	Fincha, Metahara, other public, med/small private, EMD	Input/equipment providers (inc EMD), banks, BDS providers	Industry, investment, energy policies, regulations
Distribution	Bulk distributors	Fincha, Metahara, other public, med/sml private, EMD	Transport, banks, BDS providers	Quality standards, liquid fuel distribution regulations
Retail	Retailers to final consumers	Makobu, petroleum companies, EMD, new entrants	Stove suppliers, banks, BDS providers	Ethanol supply prices, stove prices, quality
Consumption	Households, institutions	Households, social and commercial institutions (cooking)	Consumer finance, stove suppliers	Energy policy, prices

Annex A3. Institutions visited

Common list of stakeholders/institutions to be visited

Chain actors

- Sugar corporation
- Private sugar commercial
- Ethanol fuel distributors?
- Petroleum distribution companies
- Ethanol cooking fuel distributor/retailer Makobu
- Stove producers
- EMD manufacturers

Government

- MOWIE Biofuels and AETDPD and petroleum distribution
- Ministry of industry
- Ministry of trade
- Ministry of environment and forest

Bank

- DBE
- Selected MFIs

Institution	Section		
Production			
Sugar corporation		Yes	
Private Commercial Sugar farms, factories		Yes	
Processing			
Sugar corporation		Yes	
Distribution			
Ethanol fuel transport, storage (Moges)		Yes	
Petroleum distributors (NOC, Yetebaberut)		Yes	
Retail			
Moges ethanol and stove retailer		Yes	
Makobu ethanol and stove retailer		?	
Consumption			
Input providers			
Selected stove producers in Addis Ababa	Stoves	Yes	
Support providers			
Policy, regulation = enablers			
MOWIE	Biofuels	Yes	
	Alternative energy	Yes	
	MSE support	Yes	
	Petroleum distribution	Yes	

Annex A4. Notes on key stakeholders

A4.1 Sugar Corporation

Source: <http://www.etsugar.gov.et/en/projects/arjo-dediessa-sugar-development-project.html>

Fincha

- Located at Oromia regional government 350 km from Addis Ababa, East Wollega Zone AbayChomenWoreda.
- The project of the factory comes into existence first in 1977 followed by the study of the soil and topography of the area which was concluded from 1980 – 1982.
- Though there was a plan to carry out the project in joint venture by Ethiopia and Libya in 1989, the agreement went nowhere but failed.
- Obtaining a loan from African Development Bank in 1989 and the work of the main studies and development activities were conducted b/n 1992 to 1999.
- The sugarcane cultivation job of the factory was first started in 1991/92 and by then the total sugarcane cultivated land the factory had was 55.74 ha which later grew up to 6,778 ha.
- The construction of the factory comes in to completion in 1999 during which it went through trial production after commissioning. By this time the factory had a capacity of crushing 4,400 tons of cane per day. The factory in its first production year had produced 500,000 quintals of sugar. The factory at the outset was designed to produce 850,000 quintals of sugar per year crushing 40,000 quintals of cane a day. Currently it has a capacity of producing 110,000 tons of sugar a year.
- **Later on the factory had built an Ethanol producing plant with production capacity of 45,000 liter a day. This plant has a capacity of producing 8 million liter ethanol annually and till November, 2010 Fincha Sugar Factory was the only one in the nation that produces Ethanol.**
- The productivity of the factory's current cane cultivation land is 133.05 quintals of cane per ha.
- The factory is by now closer to the concluding chapter of its expansion job it had been carrying out both at its plant as well as agricultural sector. This expansion work will enable the factory plant upgrade its cane crushing capacity from 5,000 tons to 12,000 tons a day. Accordingly, improving its efficiency through time and with the help of the expansion work, the factory, by the end of the GTP period, will reach into a level of producing 270,000 tons of sugar and 20,000 miter cube ethanol annually.
- The agricultural expansion work of the factory is currently found being executed both on eastern side of Fincha River at areas known as East Bank and Neshie and also at vacant places found on western side of same river. The factory is now found carrying out this agricultural expansion job which will in the end enable it to have 21,000 ha of sugarcane cultivation land.
- Through the expansion job the factory will also have 5 agricultural villages at which it will totally have 2,975 residential houses and 30 service giving institutions.

Metehara

- Located at Oromia regional government 200 kms from Addis Ababa ,East Shoa Zone Fentale Woreda, and 8 kms from Metehara town, at a place called Merti in Upper Awash Valley;
- The increasing demand for sugar in Ethiopia and the suitability of the land and climate for sugarcane cultivation attracted HVA to extend the sugar industry to the Metahara Plains. As a result in July 1965 an agreement was signed between the Ethiopian Government and HVA under which the company acquired a concession of 11,000 ha of land and it had 234 employees. Subsequent to the signing of the agreement, sugarcane cultivation was started in 1966. Cultivating sugarcane at 3000 ha of land the factory started producing white sugar in 1969 with an initial crushing capacity of 17,000 quintals of cane per day (TCD).
- Through time the factory has carried out expansion work on its cane cultivation land and currently has 10,231 ha of land covered with cane.
- The current cane crushing capacity of the factory has reached 5,000 quintals while the productivity potential of the land is 195 tons of sugarcane per hectare.
- **Reprocessing one of the by-products of sugar- molasses the factory has begun producing Ethanol since 2011 and its Ethanol plant built at six hectares of land has a capacity of producing 50,000 liter Ethanol per day consuming 206 metric tons of molasses and using 73 tons of stem a day.**

- **The factory's annual Ethanol production capacity is 12.5 million liter.**

Wonji

- Located at South Eastern Central Rift Valley 110 km away from Addis Ababa;
- Wonji was established by a Dutch Company, HVA, in 1954 and in 1962 included Shoa Sugar Factory which is 7 kilo meters away from Wonji;
- Wonji and Shoa Sugar factories together has had a capacity of crushing 3000 tons of cane per day;
- Currently with the expansion project, construction of a new factory with a capacity of crushing 6,250 tcd is underway and will be operational shortly;
- The project includes 16,000 hectares of agricultural expansion;
- 1000 hectares out of the existing 7,022 hectares is cultivated by out growers;
- Based on the available additional land and water it is planned to increase the crushing capacity of the factory 10-12 thousand tcd and corresponding expansion of agriculture;

Tendaho

- Located at Afar Regional State 577 km from Addis Ababa, with its command area encircling some areas of Millie, Doubtti, Assaiytta and Affambo Woredas and when completed the factory will be the only huge factory both in the nation and African continent.
- **The construction of the factory was started in 2006 while the study of the project was begun in 2004. The construction of the factory will be conducted in two phases and after completion and reaching its full production capacity it will be able to produce 619,000 tons of sugar and 63,000 cubic meters Ethanol per year.**
- The productivity of the factory's cane plantation land is 125 tons per ha. Its total area of sugarcane plantation field is 50,000 ha out of which 25,000 ha will be cultivated by the factory itself and the rest 25,000 ha by cane out growers.
- Totally 17,233 residential and 308 non residential or service giving blocks will be constructed out of these the construction and consignment of some is already done.
- The factory, by the end of the GTP period, will create job opportunity to close 50,000 citizens. And, upon reaching its maximum production capacity, it will contribute from 65-70 mega watts to the national grid covering its own consumption.
- To supply water continuously to the factory's cane cultivation field and make irrigable land to natives a dam (Tendaho Dam) with a capacity of holding 1.8 billion cubic liters water is built.

Kuraz

- Located at Southern nations, Nationalities and Peoples Regional State 885 km from Addis Ababa, with its command area encircling some parts of Southern Omo, Gnanegatom and Selammago Woredas;
- It will have five sugar factories altogether having 175,000 ha of sugarcane plantation field ,
- Upon reaching their full crushing capacity three of them will have a capacity of crushing 12,000 tons of cane a day while the rest two will be built with a capacity of 24,000 TCD (Ton of Cane Crushed Per Day), Working with their maximum crushing capacity those with 12,000 TCD will produce 278,000 tons of sugar each annually while the rest two with 24,000 TCD will annually produce 556,000 tons of sugar each, Five of them together and working with their full capacity will produce 1,946,000 tons of sugar a year,
- All these factories cane plantation field get their water supply from Omo River upon which a water diverting scheme – weir with 381 meter width and 22,4 meter height will be built,
- Their plantation land productivity level is 140 tons of cane per ha,
- They all will in the end have 20,652 residential and 720 non residential houses,
- All the above five sugar factories working with their full capacity will create job opportunity to 117,131 citizens.

Beles

- Located at Amahara Regional State 650 km from Addis Ababa, Awi Zone Jawi Woreda and Southern Gojjam Zone Achefer Woreda with some part of its cane plantation field extending to some parts of Benishangul Gumuz Regional State;

- **It is a project in which three sugar factories each having 35 ha of plantation field ; Each upon reaching their respective maximum capacity will be a factory with 12,000 TCD (Tons of Cane Crushed Per Day); Accordingly, each will have a capacity of producing 242,000 tons of sugar and 20,827 cubic meter Ethanol annually;**
- Altogether working with their maximum capacity will create job opportunity to 50,199 citizens;
- All cane plantation fields of these sugar factories get their water supply from Beles River with the help of a water diverting scheme –Weir which will be built over the river with 21 meters width and 8 meters height; the productivity of their cane plantation land is 140 tons of cane per ha;
- All three factories will totally have 6,884 and 240 residential and non residential houses respectively.

Welkait

- Located at Tigray Regional State 1,350 km from Addis Ababa, Western Zone, Wolkait Wporeda
- **Gradually reaching its maximum potential it will have one sugar factory with a cane crushing capacity of 24,000 tons a day that enables it to produce 484,000 tons of sugar and 20,827 cubic meter ethanol per annum;**
- It will have 45,000 ha of sugarcane plantation field getting its water supply from Zarriema River over which a dam known by the name “May-Day Dam” will be built; The construction work of the dam is currently found being carried out by a domestic private company – Sur Construction Private Limited Company ; This dam upon completion will have 840 meter width and 135.5 meter height; The will in the end have a capacity of holding 3,497,000,000 cubic meter water;
- The productivity of the factory’s plantation land is 140 tons of sugarcane per ha;
- The factory will at last have 3,442 residential and 120 non residential houses;
- Working with its maximum crushing capacity it will create job opportunities to 33,466 citizens.

Kesem

- Located at Afar Regional State 250 km from Addis Ababa Zone Five , Awash Fentallie and Dulecha Woredas,
- It is a project with 20,000 ha of cane cultivation field that encircles areas known as Kessem and Bolhomon,
- The plantation field gets its water supply from Kessem-Kebena Dam built at Kebena River which has a capacity of holding 500 Million meter cube water,
- Upon completion and at the start it will be a factory with 6,000 TCD that gradually reaches to 10,000 TCD,
- **Reaching its maximum crushing capacity the factory will annually produce 153,000 tons of sugar and 12,500 meter cube Ethanol,**
- 288 residential houses constructed and distributed to pastoralists relocated due to the project while the construction of 551 residential houses is found under different performance level,
- Various infrastructures and social service giving institutions such as schools, health centers, potable drinking water, etc are built at their new settlement villages ,
- The project finally will have 3,442 residential and 149 non residential houses.

ArjoDedesa

- Located at Oromiya Regional State 400 km from Addis Ababa with its command area encircling some parts of Eastern Wollega, EilluAbabora and Jimma Zones following the route of Deddiessa Rift Valley;
- The factory, prior to its transfer to Sugar Corporation upon the owners free will and request, had been owned and administered by a foreign Pakistan private company known as Al-Habesha Private Limited Company which had acquired 28,000 ha of land in lease agreement signed with Oromiya Regional State in 2009 and had brought the construction of the sugar factory into completion though it failed to proceed further in the sector and finally transferred the factory to the corporation in sale;
- Sugar Corporation owning the project since 2012 is found executing various activities mainly on the cane plantation sector as almost 90 % of the construction of the sugar factory was completed while transferred to the corporation;

A4.2 Moges Haile-Selassie ethanol fuel supplier and stove producer (5 Aug 2014)

Ethanol stove

- Ethanol stove producer – modified the “Orego” (now Dometic?) stove from Sweden first in 2001?
- Produces mainly one burner ethanol stoves, but also two-burner stoves in limited quantity. Now on trial to produce three-burner stove
- The stove is made from mild steel body and aluminum canister (with heat resistant fiber glass as the medium for fuel transmission)
- the stove body is manufactured by Moges, the canister is manufactured by a local enterprise (deep drawing and seams – Kolfe metal)
- Moges has now acquired all the required manufacturing equipment for the stove except for the seaming equipment which he is expecting in three months time
- Has a utility model for the modified stove from the Ethiopian Science and Technology Commission (ESTC) in 2002?
- He has received investment license for manufacture of his ethanol stove from the Addis Ababa Investment Bureau. He has also received 1780m² land for the investment
- He has been manufacturing the stove in a small workshop he leased (rented) from the city government in the Kaliti area (an 80m² workshop that the government leases for micro enterprises)
- Sold about 500 ethanol stoves to date (mainly to employees of the Sugar Corporation, consumers in the Gerji area)
- the one burner ethanol stove is sold at Birr 385

Ethanol fuel

- Purchases ethanol from the Sugar Corporation to supply his customers – his monthly ethanol sale was about 6,000 liters (at the peak)
- Has his ethanol store and distribution unit in the Kaliti industry area (stores ethanol in plastic tankers – 2X7, 000 liter capacity tankers, 5X2, 500 liter transport tankers.
- Ethanol is stored in a room that is about 80m² in area
- He delivers ethanol to his main customers where they are (e.g. for employees of the Sugar Corporation)
- He sold ethanol at Birr 17.5/liter (last), bought ethanol at Birr 13/liter; discontinued ethanol sales four months ago

Issues (Moges's)

- Reliability of ethanol supply – uncertain supply of ethanol for cooking; frequently discontinued, sometimes preferring export to local use or providing all for the gasoline-ethanol blend;
- Pricing of ethanol – sharp price rise for ethanol in the past ten years; factory prices appear not to be linked to production costs; preferential prices for ethanol sold for gasoline blending; recently the Ministry of Trade issued a directive to us to purchase ethanol at Birr 13/liter? And sell at Birr 16/liter but this is not enough to cover our collection, transport, storage and distribution costs
- Market for ethanol as cooking fuel (promotion) – little or no promotion is done to promote ethanol as cooking fuel by the government; we are doing what little promotion we can with limited impact;
- Financing – is not a problem for Moges as he has long standing relationship with commercial banks and is a well established small enterprise. But Moges believes that it will be difficult for micro-enterprise that would be just entering the market (new producers of the ethanol stove) to obtain the financing they require because of the high collateral and other requirements of the bank; consumer financing through low stove prices recouped in the long term through fuel purchases
- Distribution points – petroleum companies will only be interested in investing in ethanol distribution (storage and pumps) when they realize there is substantial market for it. Reaching this level will take some time. The best short term solution will be for ethanol distributors like us to open distribution shops at selected sites in the city.

Recommendations (Moges's)

- Ensure ethanol supply for cooking – so that ethanol stove suppliers (producers and importers) can have stable market for their stoves);
- Competitive pricing of ethanol to kerosene (and other competing fuels) – ethanol will be widely used only when it is competitively priced with other cooking fuels. Ethanol supply to distributors should be low enough so that the distributors can deliver ethanol to consumers at competitive prices to kerosene. Distributors must have sufficient margins on fuel delivered to sustain their business
- Combined stove and fuel business – will improve the viability of ethanol/stove distributors – they can sell their stoves at low margins to expand the market and support their business with sustained revenue from ethanol fuel sales
- Promote ethanol as cooking fuel – more effort from the government
- Business incubation – (good government approach) in the form of easing housing (workshop) and other inputs for startup has helped him to continue operation while he was developing his investment plan; a good starting point for ethanol stove micro businesses

A4.3 Ministry of Water, Irrigation and Energy (MOWIE)

Biofuels Development Coordination Directorate (Nadew Tadele, Director, 31 July 2014)

- Three companies and organizations now distributing ethanol as cooking fuel: Makobu, Moges Haile-Selasie, UNHCR
- Volume of ethanol supplied (or demand and approved by the Directorate) was 600,000 (Moges), 760,000 (Makobu), 500,000 (UNHCR) for 2006 EC (2013/14). This does not however mean that the companies purchased the amount approved (according to the Director only UNHCR did so while the others have not taken all approved amount as far as he knows)
- The sugar corporation plans to engage private enterprise in ethanol production from molasses supplied from their new sugar factories

Equipment production for ethanol processing

- The relevant government agencies (ATEDPD) is adopting micro scale technologies for oil extraction and processing but not for ethanol processing (EMDs). The reason given by the Directorate was that for ethanol the strategy focuses on ethanol production from molasses from large sugar factories not on micro and small scale ethanol production.

Barriers to suppliers

- Guaranteed supply of ethanol – without it their current market collapses, they cannot work to expand their market (for both fuel and stove)
- Pricing of ethanol – they are exposed to uncertain prices for ethanol they purchase (e.g. they were one time had to pay Birr 12.28/liter of ethanol when the fuel was supposed to be sold at only Birr 10.78 for gasoline blending; then they had to raise the price for the retail to Birr 16 (losing competitiveness with kerosene and other fuels)
- Market development – ethanol distributors cannot engage in market development because they do not have guarantees (of adequate and stable supply) for ethanol; they may lose their existing customers when they cannot get enough supply or when prices rise (or are not predictable)

Alternative Energy Technology Development and Promotion Directorate (AETDPD, 7 Aug 2014)
Mulugeta Asefa, Ketema Beleme, Solomon Alemu

- Ethanol stove produced 2 years ago (2004EC, ethanol stove design and use manual published in Tir 2005EC)
- This stove is based on the Dometic CleanCook stove; also borrows from Moges's design with the fuel canister manufacture (aluminum can made at the Kolfe Household Utensils Factory); the stove weighs 3.5kg (without fuel) and the fuel canister holds 1.5Liter of ethanol
- Production cost of the stove is about Birr 200 (the canister is made for Birr 60)
- Provided stove manufacturing training to 17 metal manufacturing micro enterprises (17 personnel)
- Provided for test to fifteen MOWIE employees (for close follow up), Tahisas 10, 2005 – Tir 25, 2005EC; test households were using mainly kerosene, electricity and charcoal for cooking; two-third of the users (9 of 14) used other stoves in addition to the ethanol stove, a third only used the ethanol stove during the assessment period;
- positive attributes of the stove according to the test household was speed of cooking, easy ignition, no smoke, and safety;
- the main drawbacks pointed out by the test households were (a) the pot seat was not stable, (b) difficulty in fire control, (c) fuel tanker is not large enough, (d) flame is yellow, (e) flame is not distributed evenly
- all the test households wanted to buy the ethanol stove (Birr 250 or less)
- the CCT (cooking about 2.5kg of Mitin Shiro) conducted by AETDPD indicates that that AETDPD ethanol stove (Stove variety 2) performed well below the Dometic ethanol stove: specific fuel consumption during the CCT was 14% higher and the cooking time was 8% longer; for the AETDPD ethanol stove variety 1 the performance was 15% lower in specific fuel consumption and 13% longer in cooking time
-
- AETDPD has created a new forum for micro and small enterprises for renewable energy; this forum has the objective of increasing the engagement of enterprises in localization of energy technologies (technology localization is a term used by the government to accelerate technology transfer/local component of all manufactured products); the forum will meet quarterly to promote the engagement of enterprises in manufacture, installation and service of renewable energy equipment and services (the TOR for the forum will be developed soon)
- There are no current plans to promote ethanol as cooking fuel by the AETDPD; they are however working with the Biofuels Development Coordination Directorate to improve the ethanol stove further (budget for this activity is allocated by the Biofuels Directorate)
- Ethanol stove development started at the AETDPD when two years ago the ministers ordered the development of a local stove to address anticipated increase in ethanol production from government sugar factories
- Private or cooperative enterprises are expected to be the ones to provide the stove in MOWIE's plan; although there are no specific strategies for distribution of ethanol fuel, the expectation (and the expressed desire) is to let private companies (preferably the stove producers) to distribute the fuel as well

Petroleum Downstream Operation Regulator (Kassu Tadese, Director, 7 Aug 2014)

- No standards/operations guidelines? now in place for ethanol storage, distribution, operation
- They may be adopted from similar ISO standards (that is what is done for petroleum fuels)
- Plan to introduce standards/regulations for petroleum distribution in the near future; then petroleum distributors will have to fulfill these requirements to operate; however, operators will be given sufficient time to adhere to the new standards (to invest in equipment, manpower)
- We believe ethanol will have similar storage and distribution requirements to petroleum fuels and these may be brought in when required
- Safety, environment considerations are key requirements for storage and distribution
- Ethanol not covered under planned/underway draft regulations/proclamations? But may need to be

A4.4 FDRE Sugar Corporation

(Taitu Ali, Domestic Trade, Director, 8 Aug 2014)

- Total ethanol production plan for 2006EFY was 27 million liters; 18 to 20 million liters was to go for gasoline blending, and 7 million for other uses which includes cooking, potable alcohol, industrial and pharmaceutical uses
- The allocation of ethanol among the alternative uses is made with government stakeholders that consist of the Ministry of Water, Irrigation and Energy, Ministry of Trade, Ministry of Industry
- Government plans to promote private investment in ethanol production from molasses waste from the new sugar factories; potential investors already in negotiation (or company formation) to invest in an ethanol distillery in the Wenji area to use molasses waste from Wenji, Kesem and Tendaho; an Indian company has shown interest
- Know of an Indian company that is said to have started sugar cane production and is also installing a sugar factory; grows cane on 800ha (very small compared to government farms);

- Ethanol sold for cooking in 2006EC: Makobu, 45,600 L; Moges 61,200, Gaia/UNHCR, 150,000L;
- Ethanol amount sold for cooking declined over the period 2004 to 2006EC
- Ethanol sold for potable alcohol has 94-96% alcohol content; ethanol sold for blending with gasoline is 99.9% alcohol;
- Current prices: Birr 10.78/Liter (Birr 9.38/L before VAT, ethanol sold for gasoline blending); Birr 16/L for alcohol sold to potable alcohol producers; ethanol for cooking Birr 10.78/L with VAT now (but was Birr 12.28/L recently)
- Ethanol price has risen over the past few years because of rising costs for labour, parts and the market price for all products (including sugar)
- Four main purchasers of ethanol for potable alcohol production: Balezaf, Beherawi, Rorak, Desta (Mekele); potable alcohol producers are not expected to purchase significant volumes of ethanol
- A few potable alcohol factories have their own distilleries (the above four); a few of these used to produce ethanol from molasses purchased from government sugar factories; however, they have now stopped producing ethanol because of the enforcement of an environmental law that requires alcohol producers to also have treatment plants for waste (vinase); one alcohol producer recently installed a treatment plant for Birr 27 million (showing the significant investment that is required even for a small scale ethanol distillery)

- Cooks with ethanol stove purchased from Moges; has been using the stove for 7 months (as the main cooking fuel); fairly satisfied with performance of the stove and the fuel;

- The issues for the ethanol producers is that the distributors for cooking do not have sufficient market to purchase significant volume from the factories; they were able to purchase less than ten percent of the total allocated for them this year;
- The market is yet not developed to receive the amount allocated (2 million liters in 2006EC); market development is required

A4.5 Yetebaberut Biherawi Petroleum

Alemayehu Wolde-Michael, Managing Director, 0911 219370, alemayehu@ybpetroleum.com
On the road from Altas Hotel to Zerihun Building, 8 Aug 2014

- Showed interest early to blend ethanol with gasoline and to distribute ethanol for cooking
- Approached the government to invest in blending and distribution
- Still highly interested to engage in the gasoline blending and ethanol distribution business; willing and capable to make the required investment in distribution
- They consider it feasible to distribute ethanol in small ethanol only fuel stations (similar to those that now distribute only kerosene); pockets of land are available inside the city and they can be easily acquired by YBP for this purpose;
- They have their distribution stations mainly in the outskirts of the city (not inside the city). For this reason they will need to establish small ethanol only distribution stations inside the city (as described above)
- Investment in a 30,000L? storage and dispensing pump (special for ethanol) is estimated at Birr 0.5 million
- They believe that the margin ethanol fuel distributors (for cooking) have is quite high and attractive for other distributors; they point out that they get only Birr 0.04 per liter of gasoline sold compared to Birr 3.2/liter of ethanol sold that distributors like Makobu and Moges receive
- They point out that some markets are captive markets with high margins for distributors but with limited market reach; this they say is the case for LPG – the price in Addis for LPG is twice that in Djibouti (distributors are satisfied with large margins but limited market); the case for ethanol may be the same, they say
- The market for LPG in Ethiopia has stagnated at 8,000 tons for the past ten years or more; in the Sudan the market for LPG has now increased to more than 200,000 tons (but was about the same ten years ago)

- YBP was also in negotiations to invest in a new company with potential investors that had plans to create a new company to invest in ethanol processing from molasses that would be available from the new sugar factories (Tendaho, Wenji); the new company failed to acquire the required capital (Birr 200 million?);
- Kerosene consumption has increased according to them, not declined. The volume sold in 2006EFY was about 280 million liters (nationally). Kerosene, they point out, is now used by household for cooking but also for other purposes including adulteration of diesel, as asphalt thinner, and for other uses; they recommend price parity for kerosene (with diesel) to eliminate adulteration of diesel with kerosene
- Possible to distribute ethanol in plastic or metal bottles and cans; kerosene used to be sold in sealed metal cans (the cans were then recycled and used as holders for butter, so called “Gereweina”); but the cost of container may be too high (if supplied with container); better for consumers to bring their own containers as they are doing now for kerosene;

- The market is now too small for distributors like YBP to invest in distribution; supply is also not certain; market development is key (government and NGOs such as Gaia need to work hard on that)
- Preferential pricing of ethanol compared to kerosene is required to make it more attractive to kerosene (this should consider the lower heating value of the ethanol fuel)
- Ethanol stove should be available at low cost to expand the market; the quality of stoves must also be improved (the manager owns the Dometic stove and he said the stove does not seal well and fuel evaporates even when fully closed)
- The factory price for ethanol is too high; production cost will be much lower than current prices; government should not charge so much for ethanol when ethanol can replace imported kerosene and its other environmental benefits
- Ethanol must not be exported until all local demand is met (gasoline blend, diesel blend, cooking, other uses)

Annex A5. Extracts from the Draft National Energy Policy 2013

- Ministry of Water and Energy, 2013. ETHIOPIAN NATIONAL ENERGY POLICY (2ND DRAFT), Feb 2013
- Recent study indicated that despite the exemption from VAT and excise taxes in kerosene for household fuel, many households are shifting away from kerosene to other cheaper substitute fuel such as electricity for their daily cooking energy needs (Draft Policy, p. 15)
- Current ethanol production is 20 million liters annually; the short term plan till 2015 is to increase production by nearly ten-fold to 181.6 million liters per annum.
- By 2015, the plan is to blend mix of 20 -25% of ethanol [E20-E25] and to expand sales of blended gasoline to regions outside of Addis Ababa.
- Low private sector participation: Private sector participation in the development and supply of energy services remains very limited. Creating the favorable environment for private sector participation in the energy sector will require a substantial effort.
- Big challenge to finance the energy sector program: The energy sector is highly capital intensive sector in the country, requiring substantial investment for energy sector development and for promoting the transition from traditional solid biomass fuels to modern energy services. While, the large share of government investment is directed to the development of the energy sector, more investment is required, from diversified sources including the private sector, to get the energy sector at the level of development needed to support all economic and household sectors.
- Inadequate transfer of technology and localization: Due to insufficient technology transfer and underdeveloped industry for manufacturing, most of the energy technological hard-wares are imported, which leads to high foreign exchange spending.
- Lack of distribution system for ethanol use in the domestic sector: Ethanol could be used for household cooking through replacing kerosene. The use of ethanol in households faces two major constraints: relatively high cost of ethanol stoves compared with kerosene stoves. Furthermore, there is no network infrastructure in place for storage and supply of ethanol for domestic use throughout the country.
- Lack of integrated systematic value-chain approach: There is gap in establishing the market link between various bio-energy actors. Absence of domestic skill and infrastructure for bio-energy technology development also constrains local production.
- Policy Objective 1 - Improve security and reliability of energy supply
 - Policy instruments - Ensure ethanol supply by enhancing production.
- Policy Objective 2 - Increase access to affordable modern energy
- Encourage energy cooperatives and societies as well as private sector in energy service delivery.
- Promote local production of energy technologies through facilitating product design to lower production cost, appropriate fiscal and tariff-based incentives and other instruments.
- Policy Objective 3- Ensure bio energy supply security
 - Expand the production of ethanol to ensure security of supply.
- Policy Objective 4- Strengthen energy sector governance and build strong energy institution.
 - Engage stakeholders (private, non-government, communities, universities and research institutions) in the process of policy formulation and implementation.
- Policy Objective 6: Strengthen Energy Sector Financing
 - Attract domestic and foreign investments in energy services provision through providing appropriate fiscal and tariff-based incentives.
- Build local manufacturing capacity of renewable energy technologies through localization strategy