

# Ethanol: towards a viable alternative for domestic cooking in Ethiopia

## Key messages

- There is a strong demand for ethanol as a cooking fuel among households in all regions of Ethiopia
- Ethanol as a cooking fuel has the potential to deliver multiple benefits: improved health and financial savings at the household level; foreign exchange savings at the national level (by substituting imported petroleum); job creation and reduced deforestation and greenhouse gas emissions.
- A national bioethanol programme should be established to ensure coherent policy-making to support a market for household ethanol.
- The private sector needs to come on board as investors and implementers to promote ethanol production and demand.
- The key to stimulating private sector involvement is the regulation of input and output prices of ethanol. Regulatory reform is needed to facilitate private sector participation; this could take the form of subsidies on ethanol for users, or tax exemptions for ethanol in early stages of market development.

## Energy access and renewable energy policy in Ethiopia today

According to the International Energy Agency (IEA), sub-Saharan Africa is the only region in the world in which the number of people without access to energy is set to increase by 2030 (IEA, 2014). While many nations in the region face similar challenges, Ethiopia ranks particularly low in terms of energy progress – in 2012 the IEA’s World Energy Outlook ranked Ethiopia last out of 80 countries listed, with an Energy Development Index of 0.04 (IEA, 2012).

In order to reverse the trends in terms of energy access ranking, it has been argued that Ethiopia would need to implement a diverse portfolio of approaches, not only developing large scale utilities but also small scale, decentralized solutions beyond the grid, including the promotion of clean fuels and efficient cookstoves (Tessema et al. 2014, Sovolcol 2014).

Ethiopia has set itself the impressive goal of becoming a middle-income nation by 2025. The main vehicles for achieving this aim are the five-year Growth and Transformation Plan (GTP) and the Agricultural Development Led Industri-

**This discussion brief is based on** findings from a workshop carried out by SEI in Addis Ababa in conjunction with the presentation of the SCIP study results (see page 2). It also draws on insights given by nine experts interviewed in Addis Ababa between 27 October and 20 November, 2014 (see list of interviewees on page 4). The workshop brought together 35 stakeholders from government, civil society and the private sector, to reach a better understanding of the challenges and opportunities for operationalizing ethanol as a household cooking fuel, with particular focus on enabling private sector involvement. See the workshop findings on page 3.



Kerosene on sale in southern Ethiopia. Subsidies for kerosene are a barrier to private sector investment in ethanol.

alization strategy (ADLI), which sets out how agricultural development is expected to drive the process of industrialization.<sup>1</sup> By 2015, the country aims to reach a total capacity of 10,000 MW of electricity generated annually. Of this, it is planned that 8,000 MW will come from renewable sources (Ministry of Water, Irrigation and Energy 2012).

Ethiopia also has ambitious targets for the energy sector as a whole, not just for renewables. By 2015, it aims to double the number of power distribution lines as well as the number of consumers with electricity services (Tessama et al., 2013).

## The need for off-grid solutions

While Ethiopia’s plans for electricity generation and expanding the grid are admirable, installed generating capacity in Ethiopia is still only 2060 MW, covering about 10% of national energy demand, while only 23% of the population have access to the grid (IEA, 2014). Also, much of the planned expansion in energy generation is earmarked for export to neighbouring countries rather than to meet local demand.<sup>2</sup> Because of this, interviewees maintained that the reliability and quality of power output will remain poor in the near future, and pointed to the need for ethanol as an alternative, clean, safe and reliable option in the household energy mix, particularly in urban areas.

Workshop participants (see page 3) also doubted that the government’s ambitious efforts would translate into a shift away from biomass and kerosene to electricity for household cooking. Even if Ethiopia’s rural grid expansion efforts continue at a rapid pace, it will still be difficult to keep up with population growth alone. As of 2013, there were 94 million people in 18 million households in Ethiopia,<sup>3</sup> and if the population follows its current rate of growth (3.02% annually), it will double in the next 20 years. Even assuming that 10 million more households will be connected to the grid, at least 8 million others will not be – and they are prime candidates for off-grid solutions (Tessama et al. 2013).

## Progress on off-grid energy access

Closely linked to the GTP is the Climate Resilient Green Economy strategy (CRGE), which aims to transform Ethiopia into a carbon-neutral middle-income country, also by 2025, chiefly by expanding electricity generation from renewable sources of energy for domestic and regional markets and leapfrogging to modern

and energy-efficient technologies in transport, industrial sectors, and buildings (CRGE 2012). The CRGE includes four fast-track initiatives for implementation, one of which is to promote advanced cooking technologies. The goal is to distribute nine million improved stoves by 2015, using domestic and international climate funds to finance the effort. According to interviewees, this initiative is vital for increasing off-grid electrification, but progress has been slow, due largely to a lack of ministerial capacity and ownership. This echoes what many international and domestic voices have said about the CRGE: while it has high ambition, much uncertainty remains about how it will be implemented.<sup>4</sup>

Although Ethiopia's government does increasingly recognize the importance of decentralized, sustainable energy options for rural areas, it has largely been left to non-state actors – mainly local NGOs and international donors – to expand off-grid energy access, for example through the introduction of improved cookstoves and biogas systems (Tessama et al. 2013). Interventions in the sector are for the most part fragmented, lacking both a coherent national approach and policy vision. Several interviewees pointed to a lack of coordination among the myriad actors working in the sector, which has made it difficult to set targets or measure results.

Private sector actors, whether as investors or implementers, are key to evolving the energy access sector in Ethiopia. However, to date they have been largely absent from it for several reasons. Doing business in Ethiopia is notoriously challenging owing to lengthy contracting procedures and difficulties importing renewable energy technology, including high import duties on components (Lighting Africa 2011). Also, energy access in Ethiopia is mostly supply driven and lacks a focus on understanding consumer preferences and stimulating demand (Interview, GGGI). Efforts that the government has made include the Rural Electrification Fund (REF), established in 2003, which promotes the decentralized deployment of cost-effective renewable energy technologies, mainly through partnerships between the Ethiopian Rural Energy Development and Promotion Centre (EREDPC) and non-state actors. However, although businesses are yet to show much interest in entering this market, opportunities do appear to exist, even before adding in carbon credits or other sources of financing. One study in Addis Ababa showed that urban households would be willing to pay for the gains in health and safety that would be achieved by switching to ethanol as a clean cooking fuel (Takama et al. 2012).

### **Gaia Association – promoting ethanol for cooking**

For 10 years the Ethiopian NGO Gaia Association has been working to improve energy access by making use of surplus ethanol produced locally from molasses, a by-product of state-owned sugar factories. Gaia Association promotes bio-ethanol for cooking, and has piloted ethanol cookstoves in diverse settings ranging from refugee camps to middle-income condominium homes in Addis Ababa (Rogers, Sovacol and Clarke, 2012). Under a project led by SEI and financed by the Nordic Development Fund, Gaia Association and its partners piloted an ethanol micro-distillery in Addis Ababa that could produce 1000 litres per day. The national government has shown great interest in the project, which has also led to a study supported by the Strategic Climate Institutions Programme (SCIP) Fund<sup>9</sup> to assess the feasibility of small-scale ethanol production at the national scale.

### **SCIP findings: barriers and opportunities for scaling up small-scale ethanol production**

A feasibility study carried out by the Strategic Climate Institutions Programme (SCIP) assessed the economic, social and environmental feasibility of micro ethanol production and cookstove manufacture in all regions of the Ethiopia, for both households and the private sector (Gaia Association 2014). The study found that there is high potential for small-scale ethanol production in the regions of Amhara, Oromia, and the Southern Nations, Nationalities, and Peoples' Region, and that feedstock production would not conflict with food production in these areas. The study identified sugar cane, sugar beet, corn and multi-purpose sweet sorghum as the feedstock crops with the greatest potential. However, sugar cane produced by smallholders was found to be cost effective only where the private sector was involved and where value chains for the fuel are established. The study also found that there is enough local capacity available, in terms of materials, skilled technicians, and research and development support, to manufacture ethanol micro-distilleries (EMDs) in Ethiopia.

The study indicates that currently the only feasible market for surplus molasses is the household ethanol market, and that there is strong demand for ethanol among households in all regions, especially in urban areas. It also estimates that ethanol could displace kerosene in 100% of urban households, and charcoal in up to 50% of rural households. However, the price of ethanol per litre is important. A financial analyses of molasses as a feedstock shows that with the exception of the smallest plants (i.e. those producing up to 150 litres per day) all micro-distilleries will be economically viable at ethanol prices of ETB 10.4 per litre and upwards. Kerosene currently costs ETB 16 per litre, ethanol (produced in large factories) costs ETB 13.99 per litre, and charcoal ETB 8.7 per kilogram. The SCIP analysis showed that, based on these prices, the average urban household would be better off by switching to ethanol for cooking, saving around ETB 136 per year if switching from charcoal, and ETB 450 per year from kerosene (SCIP Feasibility Report, 2014).

Although the SCIP study did indicate a demand for ethanol as a cooking fuel in rural areas, it will be more challenging to encourage rural households to start using ethanol as part of their energy mix than urban households, given that most rural people rely on gathered fuelwood for cooking – which is cheap or free – and because average incomes are so much lower than in urban areas.

Thus, the high price of ethanol relative to biomass fuels is a barrier to rural uptake, which in turn creates barriers for a sustained and thriving market. And the comparatively low average income in rural areas puts at risk the economic sustainability of the ethanol supply chain, at least until a critical mass is reached. Government incentives could help to overcome these barriers, and could include direct subsidies for ethanol (similar to the existing subsidy for kerosene), and targeted support for private-sector producers of molasses, including provision of arable land for production and factory sites.

It also appears that small-scale ethanol could address many government policy priorities, including energy access, energy security (by saving foreign exchange on petroleum imports), rural development, job creation, and environment and climate change objectives (all CRGE targets).





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NCF-financed ethanol micro distillery, Addis Ababa, Ethiopia

There is great potential for the private sector to be involved in developing the household ethanol value chain, from feedstock production to construction and operation of EMDs, to cookstove manufacture and fuel retail. While a number of businesses have shown interest in investing, major barriers are deterring them. The main barrier is low profit margins. The government sets an unrealistic retail price for ethanol of ETB 13.99 per litre, while the factory gate price is ETB 10.78. This means that small-scale producers can't cover their costs, or compete with kerosene, which is subsidised by the government. Other barriers include fluctuations in the price and supply of molasses. The private sector will not invest until these risks are tackled by regulatory reform.

### Findings from the workshop and interviews

The workshop was structured around two main questions, and participants responses are summarised below.<sup>7</sup> Ten interviews were also carried out with key informants.

#### Question 1. What key changes are needed for the private sector to come on board? Who has to act for this to happen?

A majority of participants agreed that *the key to stimulating private sector involvement is to regulate the input and output prices of ethanol*. In other words, small-scale ethanol producers need a steady long-term supply of feedstock (molasses is the most feasible option) at a competitive price, as well as access to arable land to produce high-quality feedstock and land allocated for distilleries. Producers also need ethanol to be priced competitively with other fuels (kerosene in particular), and participants agreed that the Ministry of Trade, the Federal Taxation Office and the Ethiopian Revenue and Customs Authority are most able to bring about price change.

In order to *remove barriers on the supply side*, several participants highlighted the need for revision of the Ethiopian Biofuel Development and Utilization Strategy. The strategy states that biofuels may only be produced on degraded land because of concerns about competition with food production (Ministry of Mines and Energy 2008). But the SCIP study demonstrated that in certain regions growing feedstock on non-degraded land would not pose a threat to food security. Workshop participants agreed that the Ministry of Irrigation, Water and Energy is best placed to revise the strategy, and in fact one interviewee indicated that such revisions are currently being considered within the ministry.

Many workshop participants, as well as several interviewees, agreed that *the government needs to play a central role in promoting ethanol for household cooking to stimulate demand amongst households*. Because the government has a federal structure, it has the potential to act at the national level through to local zones, districts (Woreda), and even neighbourhoods (Kebele), which would be useful in a national campaign.<sup>8</sup> For such a campaign to happen, key ministries, in particular the Ministry of Irrigation, Water and Energy, would need to prioritise ethanol for household cooking. A number of interviewees suggested that launching a national bioethanol programme, similar to the national biogas programme, could be a first step towards demonstrating this commitment.

#### Question 2. If these conditions were in place, would they be enough? What else would need to change?

Participants stressed that *the public sector remains vital for advancing ethanol production*, particularly the Office of Regional Administration and Implementation, and that public sector actors should be more active and operational. It was also emphasized that “policy in itself is not a goal”, and that implementation and participation on the part of regional government and bodies such as the Ethiopian Sugar Agency, the Federal Taxation Office and the Ethiopian Revenue and Customs Authority, will be crucial.

In order to make ethanol viable across the entire country, participants pointed to the need for special support for emerging regions (such as east Somali, Afar, west Benishangul-Gumuz, and Gambella), including national government subsidies to support market development. This would stimulate production and dissemination of ethanol and help produce and deliver the necessary cooking technologies. Participants also highlighted the importance of continuous monitoring and follow-up, not least in order to identify problems and make amendments to the implementation strategy.

### Policy implications

- There is a need for a comprehensive market assessment to deepen understanding of the demand and prospects for ethanol as a domestic cooking fuel. The assessment should focus on user preferences, including a realistic degree of stove switching and fuel stacking, and should begin with priority regions.
- Stronger government commitment – specifically from the Ministry of Irrigation, Water and Energy – to ethanol as a household fuel is crucial. Such commitment might include a national bioethanol programme, with a long-term policy framework specifying who does what, over what timescale, with what resources, and where those resources would come from. It would also involve leveling the playing field for ethanol compared with electricity, kerosene and liquid petroleum gas (LPG). Funding for such a programme could, for instance, be raised by a tax on imported fossil fuels.
- Regulatory reform would encourage the private sector to come on board. Effective measures would include supply and demand incentives, such as price subsidies on ethanol to generate demand. Such targeted interventions will be vital for stimulating private sector involvement in a sector that has long been dominated by international donors and the government.

## List of interviewees

Desalegn Getaneh. Gaia Association  
Daniel Yeo. Policy advisor, Global Green Growth Institute  
Jane Adisu. Vice Country Director, SNV Ethiopia  
Getanet Alemaw. Independent consultant on ethanol feedstock  
Hilawe Lakew. Ethio Resource Group  
Hiwote Teshome. Sector expert, household energy and biofuels  
Ato Nadew Tadele. Biofuels Development and Coordination Directorate, Ministry of Water, Irrigation and Energy  
Endalkachew Mekonnen. Addis Ababa University  
Lars Ekman. Norwegian Embassy, Addis Ababa  
Klaus Helmgens. Massive Dynamics

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## Endnotes

- 1 See: [ethioagp.org/background](http://ethioagp.org/background)
- 2 Ethiopia has already started exporting 70 MW of electricity to Djibouti and 100 MW to Sudan, and has also made export deals with Kenya, to which it plans to export 400 MW, and with South Sudan See: [www.ft.com/intl/cms/s/0/14d2026a-902d-11e3-a776-00144feab7de.html#axzz3Xl6hU6GO](http://www.ft.com/intl/cms/s/0/14d2026a-902d-11e3-a776-00144feab7de.html#axzz3Xl6hU6GO); [www.globalconreview.com/sectors/ethiopia-aims-be-renewable-power-house-africa](http://www.globalconreview.com/sectors/ethiopia-aims-be-renewable-power-house-africa); [www.africareview.com/Business---Finance/Ethiopia-earns-big-from-energy-exports/-/979184/2315884/-/115ach2/-/index.html](http://www.africareview.com/Business---Finance/Ethiopia-earns-big-from-energy-exports/-/979184/2315884/-/115ach2/-/index.html); and [www.bloomberg.com/news/2014-03-19/ethiopia-sees-output-from-africa-s-biggest-power-plant-by-2015.html](http://www.bloomberg.com/news/2014-03-19/ethiopia-sees-output-from-africa-s-biggest-power-plant-by-2015.html)
- 3 See: [data.worldbank.org/country/ethiopia](http://data.worldbank.org/country/ethiopia)
- 4 See e.g. Jones et al. 2013 on challenges to implementing the CRGE.
- 5 See: <http://www.thereporterethiopia.com/index.php/news-headlines/item/1279-new-proclamation-to-establish-energy-authority>
- 6 Interview, Massive Dynamics, 21 Nov. 2014.
- 7 A participatory method, "think, write and share" was used to generate insights from the participants. The method has been widely applied, e.g. in the constitutional reform of Iceland to vision planning for cities and private enterprises. The process emphasizes deep dialogue between a small group of individuals and is designed to capture every idea brought forward by each participant. It is open sourced. For enquiries about the methodology, contact: [alda@vendum.is](mailto:alda@vendum.is)
- 8 This approach was used successfully to promote kerosene for cooking. Eventually the private sector took over.
- 9 The SCIP Fund is supported by the governments of the UK, Norway and Denmark and channels grant funding to support Ethiopian stakeholders; including government, civil society, private sector, research organisations and supportive international development partners, to respond to the opportunities and challenges of climate change. See [www.kpmg.com/eastafrica/en/services/advisory/development-advisory-services/services\\_and\\_expertise/renewable\\_energy\\_and\\_adaptation\\_to\\_climate\\_change/scip/pages/default.aspx](http://www.kpmg.com/eastafrica/en/services/advisory/development-advisory-services/services_and_expertise/renewable_energy_and_adaptation_to_climate_change/scip/pages/default.aspx).

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This research was part of a project funded by the Nordic Climate Facility (NCF) called Fuel from Waste: Demonstrating the Feasibility of Locally Produced Ethanol for Household Cooking in Addis Ababa. NCF is financed by the Nordic Development Fund (NDF) and Sida, and implemented jointly with the Nordic Environment Finance Corporation (NEFCO).

### Published by:

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2015

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