

Dalberg

# DEVELOPMENT OF ETHANOL COOKING FUEL MASTER PLAN FOR KENYA

DALBERG PRESENTATION  
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Supported by:



Federal Ministry  
for the Environment, Nature Conservation  
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based on a decision of the German Bundestag

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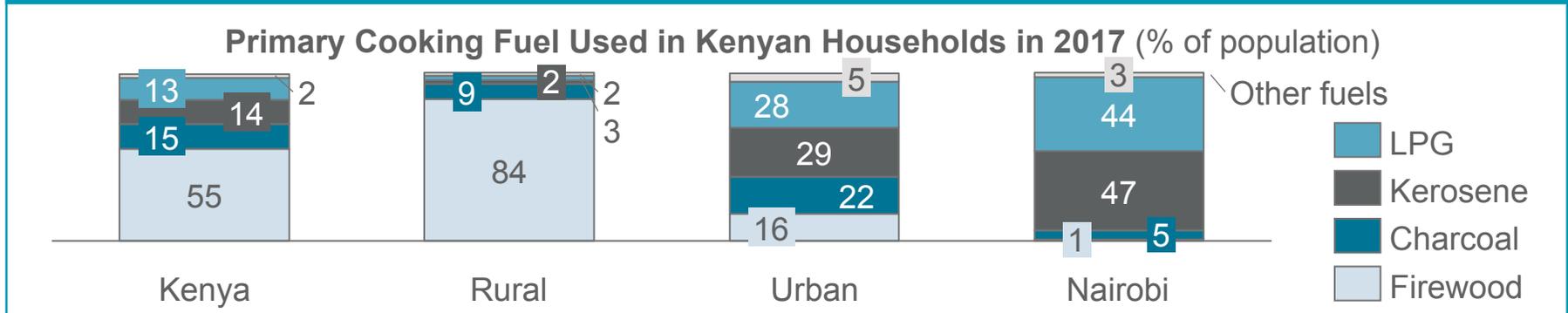
**OVERVIEW OF COOKING FUELS USAGE IN KENYA**

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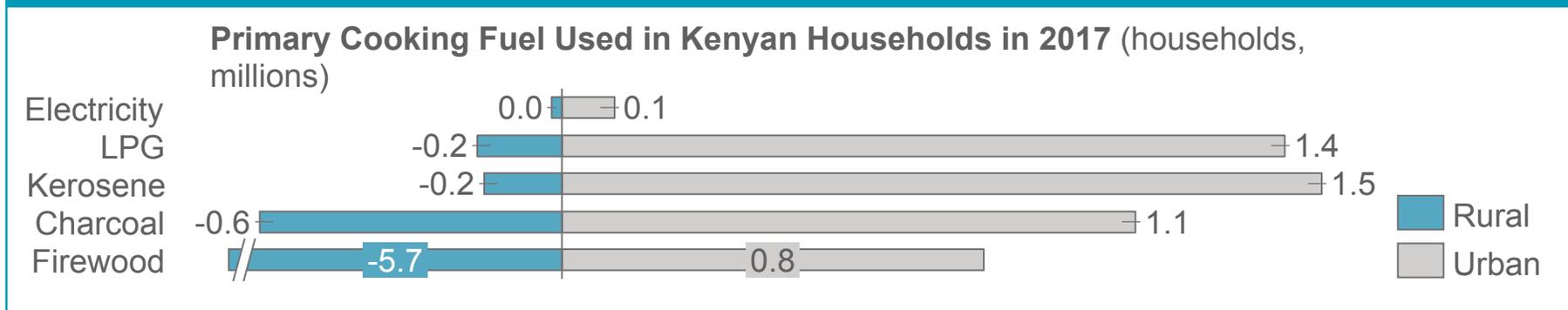
**PROPOSED FOCUS OF THE ETHANOL COOKING FUEL 2019 MASTER PLAN**

# The urban Kenyan cooking fuel market is estimated at KES 60bn – KES 80bn per annum, and remains dominated by dirty fuels

In urban Kenya, the majority still use charcoal and kerosene; this number is much higher when fuel 'stacking' is included



Kenyan urban households are now ready for rapid uptake of clean, modern fuels



\*This market size estimate is based on current urban population size, fuel use patterns, estimated household consumption/spend (based on average efficiencies of cookstoves/fuels in the market), and market price data for urban Kenya  
 Source: Kenya National Bureau of Statistics (2018); Dalberg analysis

# Transitioning charcoal / kerosene users to Bio-ethanol and LPG will have significant health, environmental, and economic benefits for Kenyans

	Charcoal	Kerosene	LPG	Bio-ethanol*
Health	Highest PM2.5 <sup>1</sup> exposure	High PM2.5 <sup>1</sup> exposure	Lowest PM2.5 <sup>1</sup> exposure	Low PM2.5 <sup>1</sup> exposure
Environment	Highest Greenhouse Gas emissions. Key driver of deforestation and, food insecurity	Lower Greenhouse Gas emissions than charcoal, but still higher than ethanol and LPG	Low Greenhouse Gas emissions	Lowest Greenhouse Gas emissions
Consumer economics	One of the cheapest option, but prices rising	Recent tax increases driving up prices	Still relatively expensive for most households	Prices comparable to LPG; potential price reductions at scale
National economics	Existing jobs, are low-quality and informal; benefits unlikely to make up for value-destruction cause by deforestation	Negative impact on trade balance given imports	Negative impact on trade balance	Domestic production and job creation Shorter-term negative impact on trade balance (until domestic industry grows)

**A transition of all charcoal / kerosene users in Nairobi to Bio-ethanol could result in up to 2.4mn tonnes GHGs, 200K Disability-Adjusted Life Years<sup>2</sup> (DALYs) and 1,500 deaths averted p.a.**

Note: 5kg of cherries = 1kg of parchment = 0.8kg of green beans Source: Interviews, Dalberg analysis

<sup>1</sup>PM2.5 is an air pollutant that is a concern for people's health when levels in air are high. <sup>2</sup>DALYS is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death.

# LPG and Bio-ethanol are becoming more competitive with traditional fuels, and present a huge opportunity for impact in Kenya

	LPG	Bio-ethanol
Cost to consumer	<ul style="list-style-type: none"> <li>Annual cost of cooking: <b>\$233 / HH</b></li> <li>Stove cost: <b>\$100-120 for a 2-burner</b> (incl. hose, regulator, cylinder deposit)</li> </ul>	<ul style="list-style-type: none"> <li>Annual cost of cooking: <b>\$220-230 / HH</b> with newest models (<b>including taxes</b>)</li> <li>Stove cost: <b>\$45 for a 2-burner</b></li> </ul>
Cost of scaling	<ul style="list-style-type: none"> <li>Cost of extending supply to 2mn additional HHs in urban Kenya: <b>~\$290mn</b></li> </ul>	<ul style="list-style-type: none"> <li>Cost of extending supply to 2mn additional HHs in urban Kenya: <b>~\$16mn</b></li> </ul>
Social and health impacts	<ul style="list-style-type: none"> <li><b>Up to 30 trees saved per HH</b> annually from switching from charcoal</li> </ul>	<ul style="list-style-type: none"> <li><b>Up to 30 trees saved per HH</b> annually from switching from charcoal</li> </ul>
	<ul style="list-style-type: none"> <li><b>3.1-4.6 tonne reduction in GHG emissions</b> per HH per year</li> </ul>	<ul style="list-style-type: none"> <li><b>3.3-4.8 tonne reduction in GHG emissions</b> per HH per year</li> </ul>
	<ul style="list-style-type: none"> <li><b>~0.25 DALYs saved per HH</b> per three year intervention period from switching</li> </ul>	<ul style="list-style-type: none"> <li><b>~0.25 DALYs saved per HH</b> per three year intervention period from switching</li> </ul>
	<ul style="list-style-type: none"> <li>Reduction of <b>55 deaths per 25,000 HHs</b></li> </ul>	<ul style="list-style-type: none"> <li>Reduction of <b>55 deaths per 25,000 HH</b></li> </ul>
Macro-economic impacts	<ul style="list-style-type: none"> <li><b>Negative impact on trade balance</b></li> </ul>	<ul style="list-style-type: none"> <li><b>Domestic production and job creation</b></li> <li><b>Shorter-term negative impact on trade balance</b> once domestic industry grows</li> </ul>

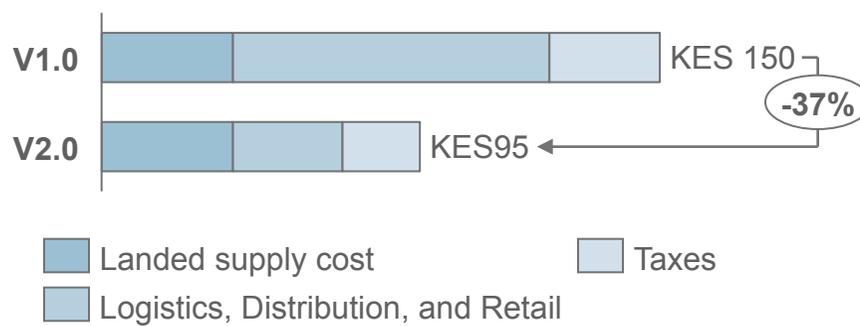
Note: 5kg of cherries = 1kg of parchment = 0.8kg of green beans Source: Interviews, Dalberg analysis

# Bio-ethanol is now cost-competitive in urban Kenya, using new technologies and existing liquid fuels infrastructure

## Key innovations...

- Bio-ethanol **“dropped in”** on liquid fuels infrastructure, stored at petrol stations
- **Customised hardware and software technologies** for last mile distribution, dispensing and home use

## ...enable retail of ethanol at ~40% lower prices than “V1.0 Centralised Bottling” approach



## Case study: Vivo Energy and KOKO Networks



Vivo sources ethanol, stores at petrol stations, and delivers to small shop retailers



Vivo's Smart MicroTankers manage last-mile delivery to KOKOpoint Fuel ATMs inside neighbourhood KOKO Agent shops



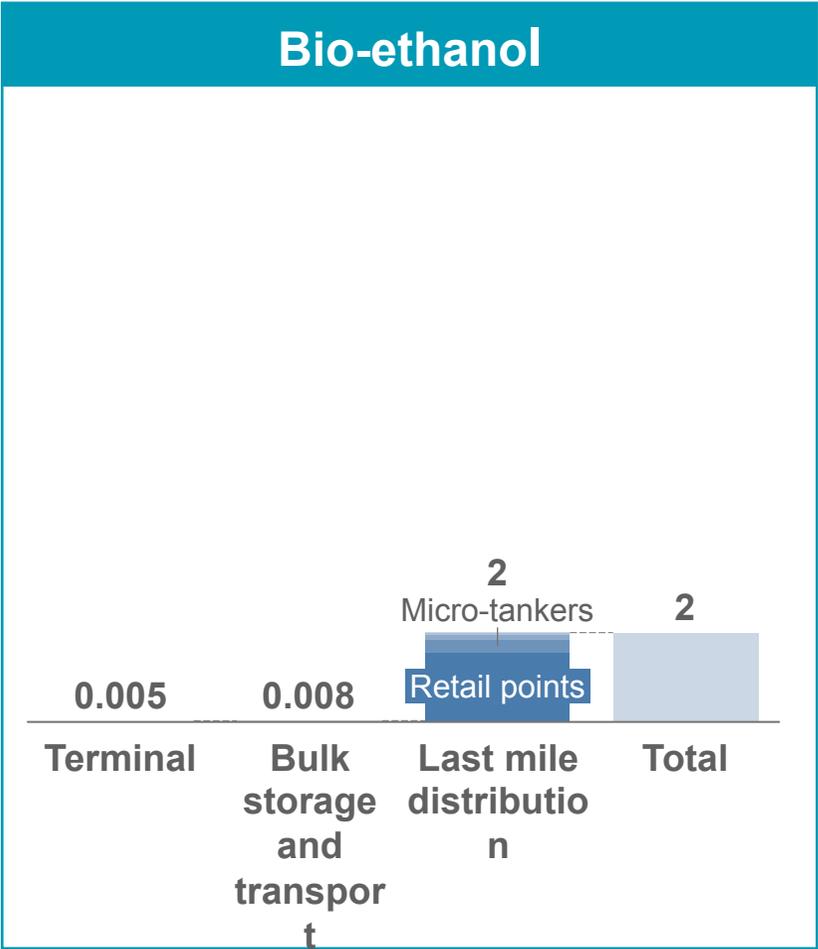
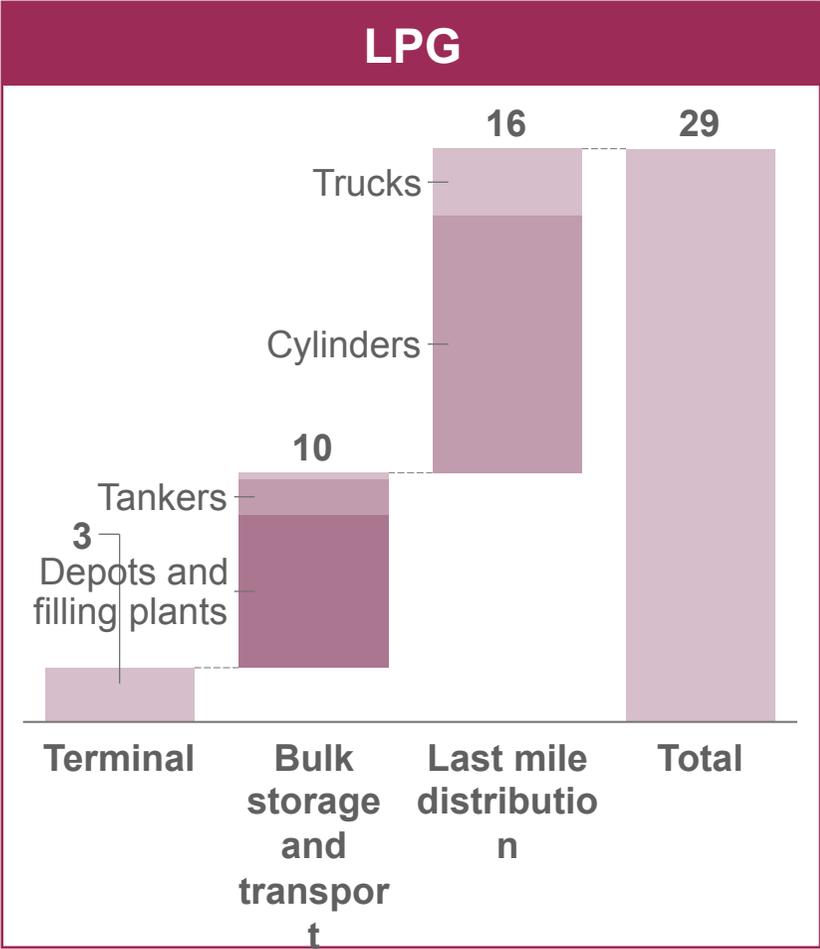
Customers refill their Smart Canisters at KOKOpoints, with fuel refill bundles starting from KES 30



Customers, KOKO Agents and Vivo infrastructure connected to KOKO Cloud

# Scaling Bio-ethanol requires 18x less capex than scaling LPG

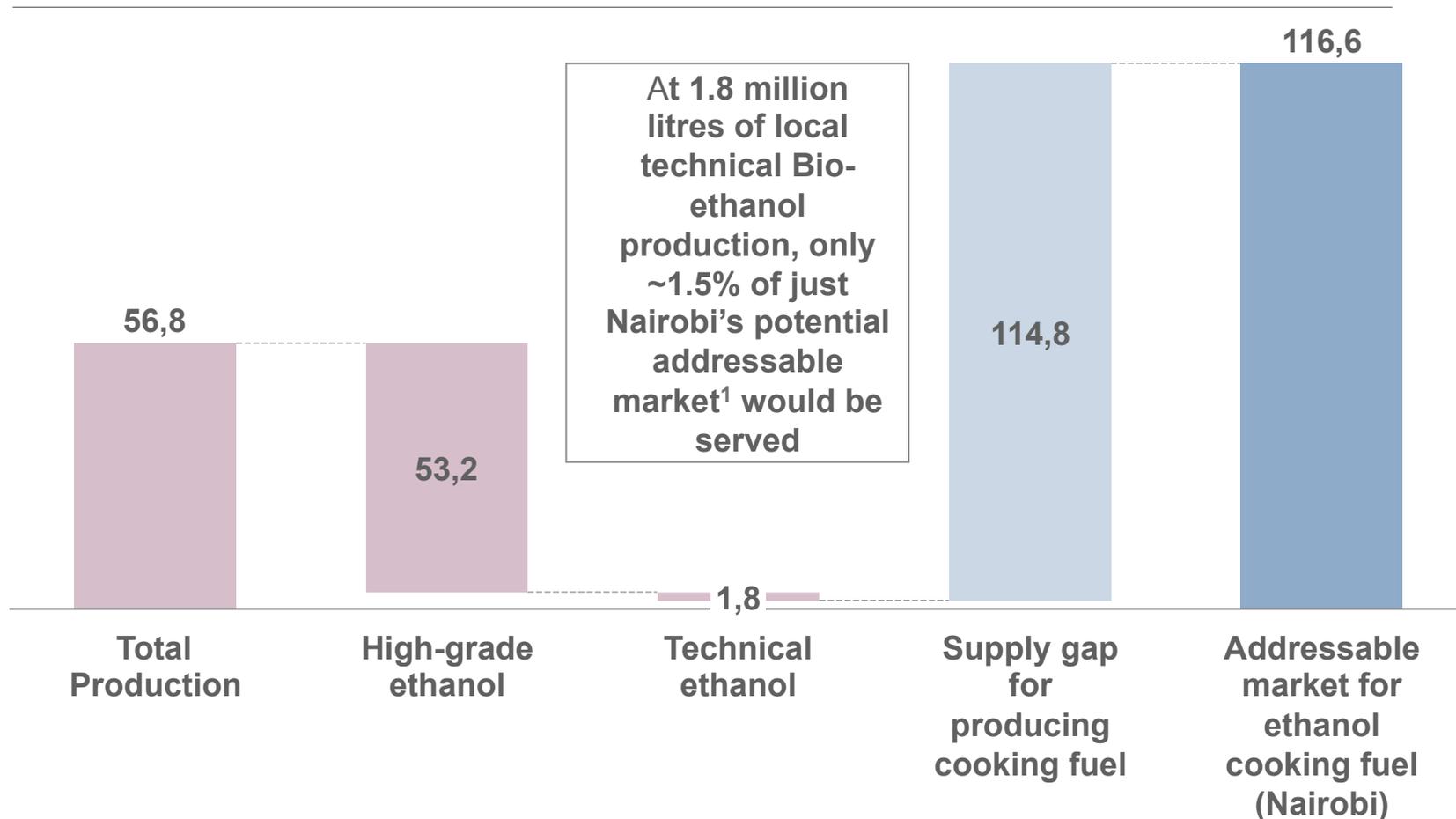
Incremental investment required to extend supply to 2 million additional HHs in urban Kenya (KES billion)



Note: Terminal includes (1) LPG: terminal capacity increase, (2) Bio-ethanol: fuels lines from ship to port.  
 Source: GLPG Kenya Market Assessment, 2013; KOKO Networks; expert interviews; Dalberg analysis

Given the supply gap for producing cooking fuel, there is a significant opportunity for a local industry to develop over time

Bio-ethanol volumes in Kenya (million litres per year)



# The Government of Kenya has intervened to promote LPG; policy actions have also leveled the playing field for Bio-ethanol



- **‘Kerosene-Free Kenya’ campaign** aims to phase out the use of kerosene for lighting and cooking, and replace it with clean energy sources. This would also reduce the illicit use of kerosene to dilute diesel
- **Efforts to regulate the charcoal industry** by providing support for sustainable production and community forest management are minimizing impact of charcoal use

- **VAT zero-rating for LPG** has reduced prices and **Mwananchi Gas Project** plans to subsidize cost of cylinders
- **Removal of duties and VAT on Bio-ethanol** fuel reduces cost to customers

	Policy support	LPG	Ethanol
FUEL	Remove import duty	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	VAT zero-rating	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
APPLIANCE	Reduce import duty	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Remove VAT	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Subsidize appliance	<input checked="" type="checkbox"/>	<input type="checkbox"/>

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PROPOSED FOCUS OF THE ETHANOL COOKING FUEL 2019 MASTER PLAN

# Dalberg is working on a Bio-ethanol Cooking Fuel Master Plan 2019 for Kenya

## Scope of Work

- 1) Estimate **projected demand** of bio-ethanol as a cooking fuel in Kenya by 2029
- 2) Estimate **projected supply** of bio-ethanol as a cooking fuel and the timeframes for ECF production in Kenya
- 3) Develop a **dynamic financial model** for key investment requirements associated with the ECF Master Plan
- 4) Develop a **high-level impact model** on the potential benefits of ECF including gender and youth dimensions
- 5) Analyze **relevant government policy** and legislation

## Project Objectives

To develop a **master plan for ECF** in Kenya that:



Provides **actionable recommendations** for both the private and public sector



Engages **key government stakeholders** enabling them to develop ownership of the plan

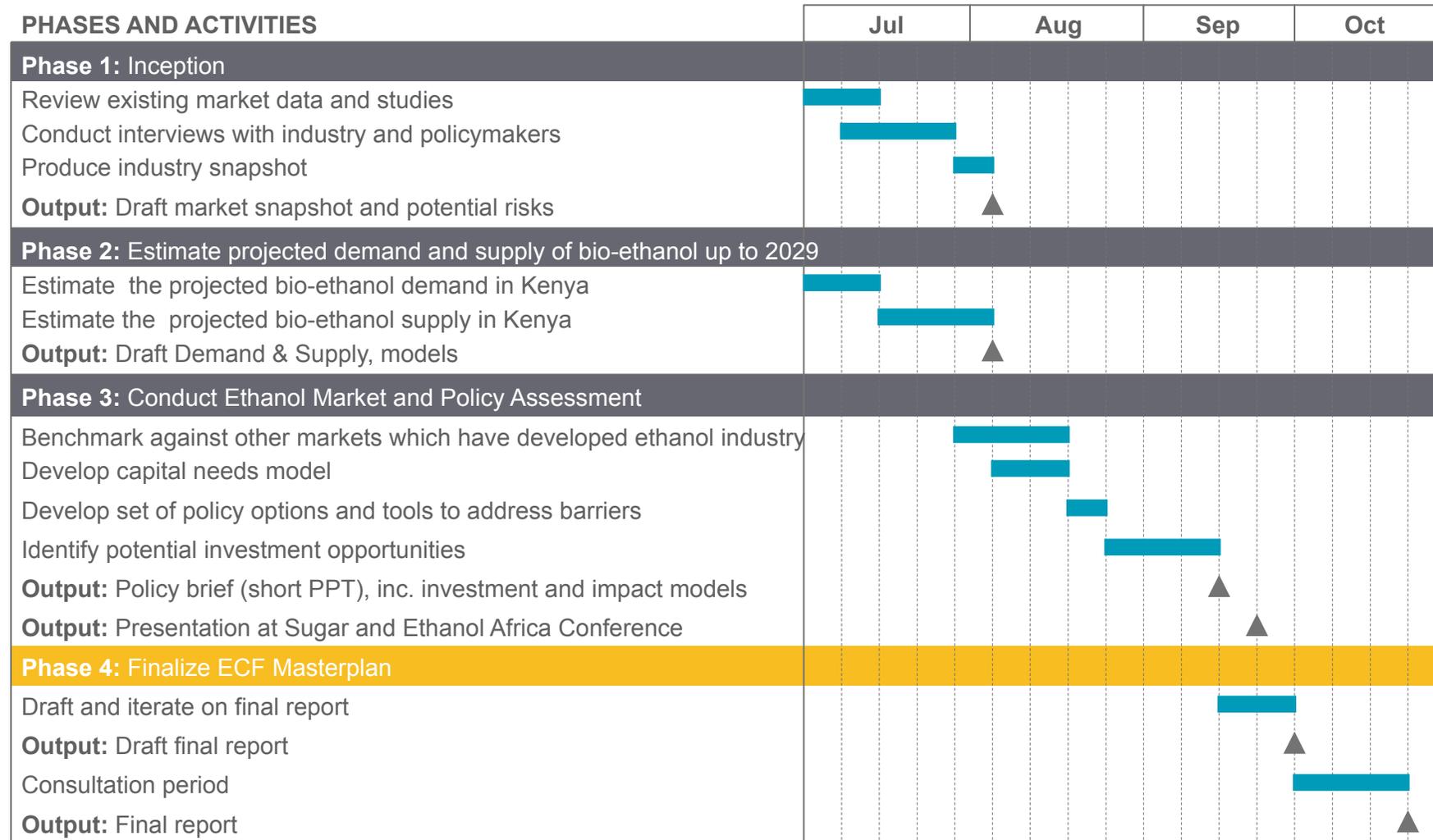


Engages the **private sector** – potential investors in bio-ethanol both domestic and foreign – as well as the **wider donor community**



Identifies **investment opportunities** in ethanol production

# Dalberg's engagement will run over 4 months including consultation



# Next steps

1

Create a **working group** including the Ministry of Industrialization, Agriculture, Energy, Health and Environment to ensure ongoing alignment and consultation

2

Engage **private sector stakeholders** including the Kenyan sugar industry, fuel distributors and potential investors – both domestic and foreign – in ethanol production

3

**Conduct analysis** based on interviews with industry and policymakers to estimate projected demand and supply of bio-ethanol as a cooking fuel over the next 10 years

4

**Provide actionable recommendations** for the private and public sector to ensure the development of a domestic bio-ethanol ecosystem in Kenya