Climate change impacts and decarbonization of woodfuel (charcoal and firewood) systems in Kenya

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Introduction

Cooking with Three stone open fire

- About 80% of the population in SSA depend on solid biomass for energy supply (IEA, 2017).
- Woodfuel, though a renewable form of energy, inefficiencies in production and use systems have been associated with devastating ecological and environmental impacts(FAO,2017)

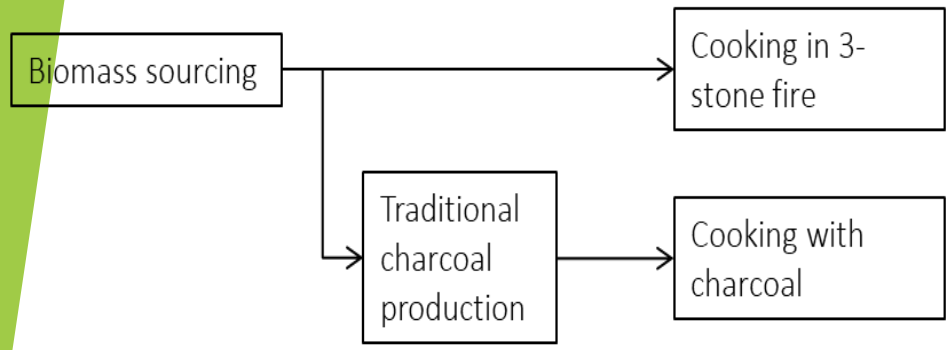
Wood charcoal

Charcoal and firewood (woodfuel) situation in Kenya

Fuel	% household using it as main cooking fuel (National Census: KNBS , 2019)			Production /Deficit (MENR, 2013, MoE & CCAK 2019)
	Urban	Rural	National	
Firewood (Weekly consumption of 26.2kg and 23.7kg in rural & urban areas respectively)	9	**84**	67	Deficit 27%
Charcoal (Weekly consumption of 7.9kg and 7kg in rural & urban areas respectively)	**18**	8	12	Growth by 56% 2002-2013. Deficit 55% (Worth USD1.6 billion)
Liquid petroleum gas (LPG)	53	7	24	
Kerosene	18	2	8	

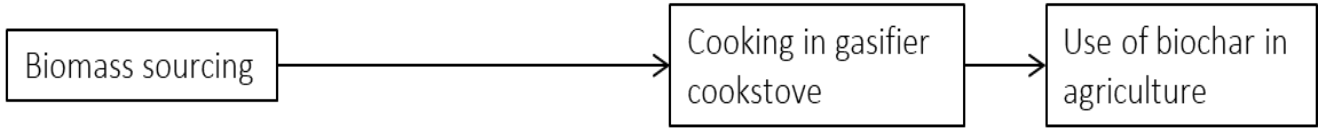
Climate impacts of bioenergy-biochar systems

1) Reference: Current practices

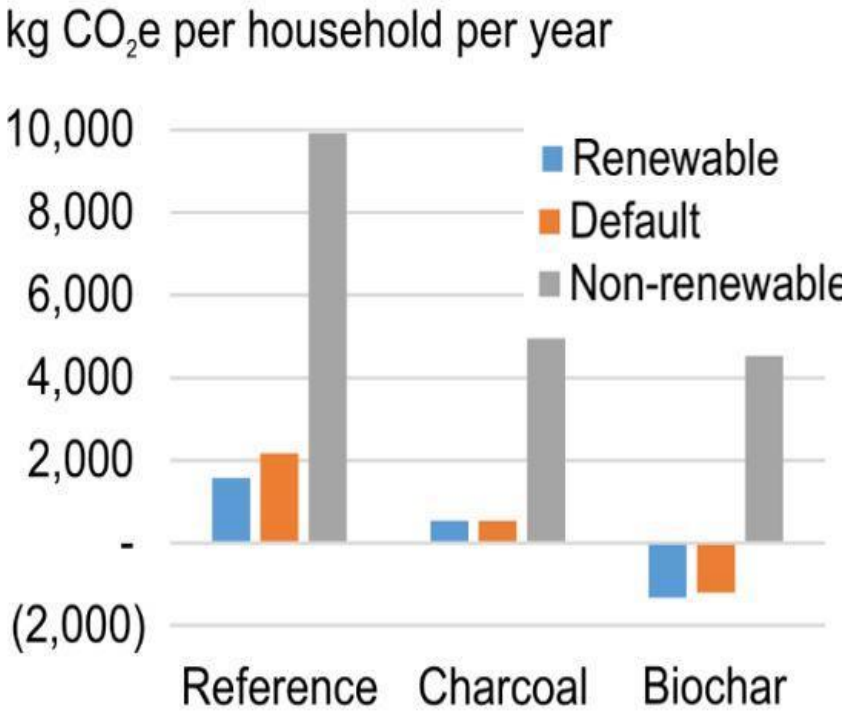


2) Charcoal

3) Biochar



Three stone open fire (reference) and gasifier cooking systems (global warming potential (GWP) 100 years)



Sundberg et al, 2020

Gasifier

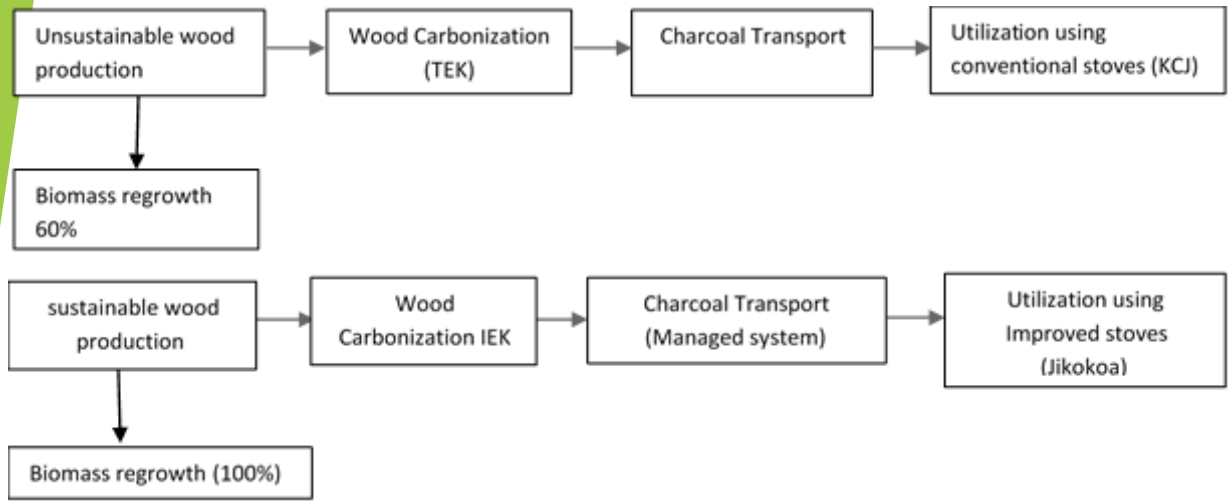
Photos: Njenga/ICRAF

Charcoal climate impacts

TEK in Baringo, Kenya
Photo. Erick, 2021.

Kiln technology	% yield	Source
Traditional earth mould kiln (TEK) in SSA	7-15	Schure et al., 2019, Njenga et al., Forthcoming
Improved earth mound kiln (IEK) in SSA	21-27	Oduor et al., 2006, Njenga et al., Forthcoming Schure et al., 2019

IEK in Baringo, Kenya.
Photo Moses Kirimi 2019.



(Kirimi et al., Forthcoming; Njenga et al., Forthcoming)

- Simple improvements of TEK @USD55, increased yield by 49%, reduced CO, CO_2 and CH_4 emissions by 40%, 49% and 44% respectively.
- Improved charcoal stove reduced fuel consumed in cooking a meal by 26% & GHG by 22% and 21% over 100 & 20 year time horizon respectively.

KCJ. Photos: Fassio/CIFOR

Jikokoa. Photos: Fassio/CIFOR

Climate impacts of charcoal briquettes

Recovery of charcoal dust for fuel briquettes

Common practice for C+charcoal briquette

Acacia drepanolobium native woodland

Wood carbonization with low efficiency traditional kiln

Improved scenario for C+charcoal briquette

Acacia mearnsii plantation

Wood carbonization with high efficiency improved kiln

Charcoal transportation by lorry

Sourcing water from river

Briquette production using charcoal dust

Household's use of charcoal briquettes

Sourcing of soil from river banks and road reserves

5.36-1.64CO_{2eq}/meal
Maize+beans (Githeri)

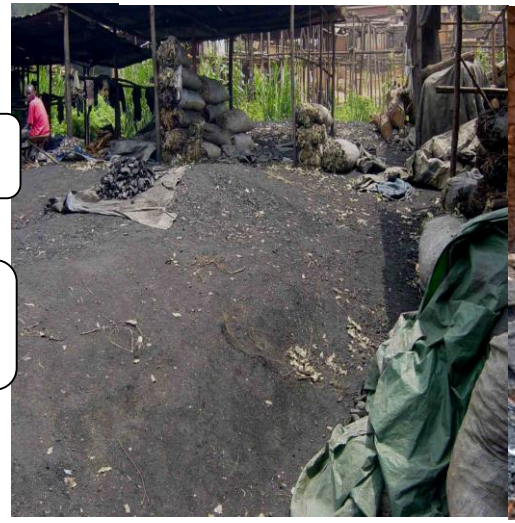
Charcoal 6.4-2.01CO_{2eq}

4.12-1.59CO_{2eq}

Charcoal 4.94-1.96CO_{2eq}

Njenga et al 2014

Charcoal dust+soil (carbonized)briquettes

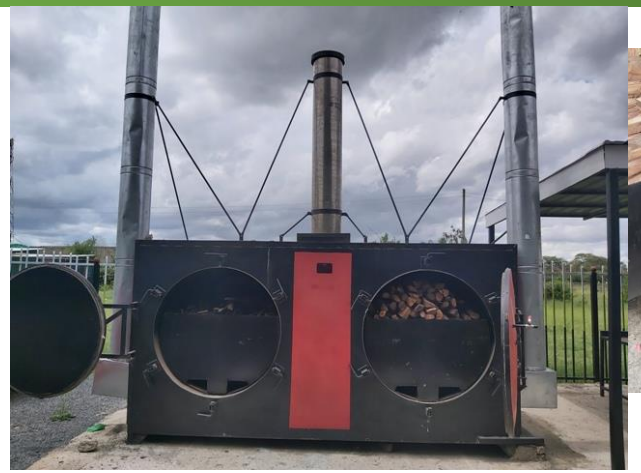


Take home Lessons

Invasive Prosopis woodlots in Baringo, Kenya Photo: Danyell Odhiambo/ICRAF

Measuring emissions from improved earth mound kiln (IEK) Photo Mary Njenga 2019

- To reduce the climate impacts of woodfuel, a systems approach is necessary in addressing inefficiencies at every stage in the charcoal life cycle.
- For adoption of sustainable and efficient practices, technology development and transfer should be carried out hand in hand or with the users' interest in mind.
- There is need for further studies on various biomass production systems, processing and use technologies to produce data to inform policy development and commercialization



Retort kiln Fusion Experience Ltd Nairobi. 34% efficiency

Briquette production from tree branches in drylands

Further Reading

FAO (2017) The charcoal transition: Greening the charcoal value chain to mitigate climate change and improve local livelihoods, by van Dam J Rome: Food and Agriculture Organization of the United Nations

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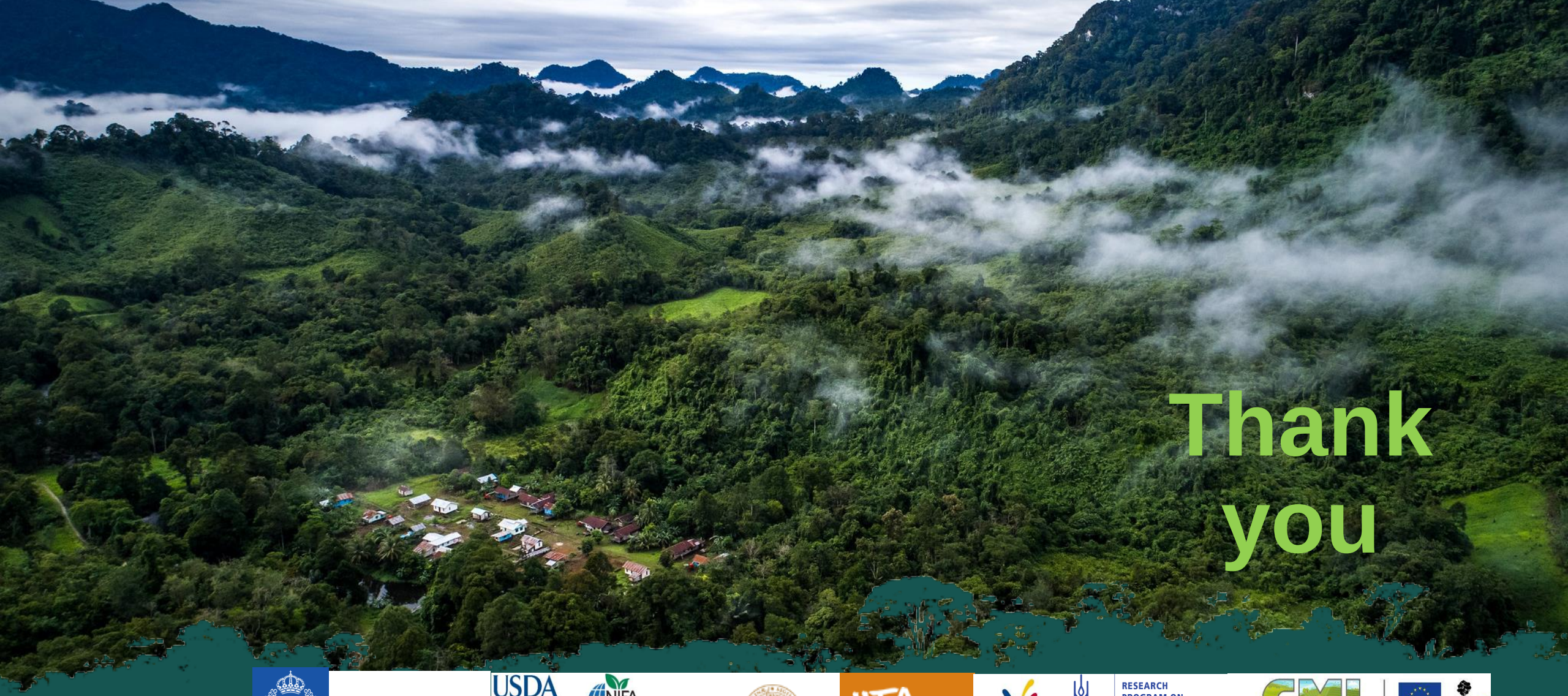

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