KENYA: COUNTRY LEVEL LCA ASSESSMENT

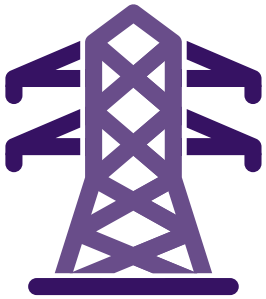
An assessment of impacts on health, ecosystems and resource use of the transition to e-cook.

MECS Modern Energy Cooking Services

The transition to e-cook from traditional cooking fuels can deliver a range of benefits (and possible impacts) to human health, ecosystems and resource use. Using a Life Cycle Assessment approach, these have been analysed across the full life cycle of cooking, from raw material extraction to final disposal of the cooking devices and the different fuels used.

Taking 2019 as the base year, Kenya had a population of 50 million, with an average family size of 3.9 people. The population was split 72% rural and 28% urban, with 61.9% of the rural population having access to electricity and 90.8% of the urban population able to access electricity (World Bank). The main fuels used for cooking were firewood, charcoal, kerosene, LPG and electricity. (WHO data)

	% Rural pop	% Urban pop	% Total pop
Kerosene	0.7	12.8	5.1
LPG	2.3	22.2	9.6
Firewood	86.7	30.5	66.4
Charcoal	9.3	27.4	16.5
Electricity	0.1	1.5	0.5



61.9% RURAL ACCESS TO ELECTRICITY

90.8% URBAN ACCESS TO ELECTRICITY

The daily fuel consumption per household is given below.

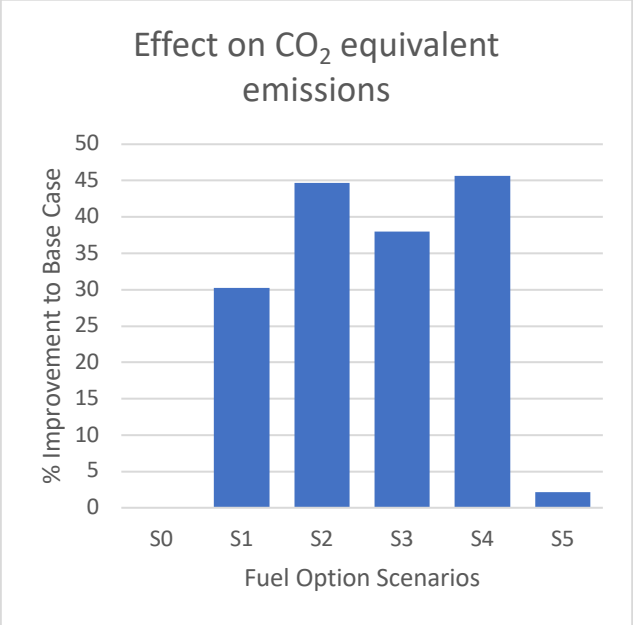
	Per HH per day
Kerosene	0.25 Kg
LPG	0.23 Kg
Firewood	3.5 Kg
Charcoal	1.75 Kg
Electricity	1.92 KWh

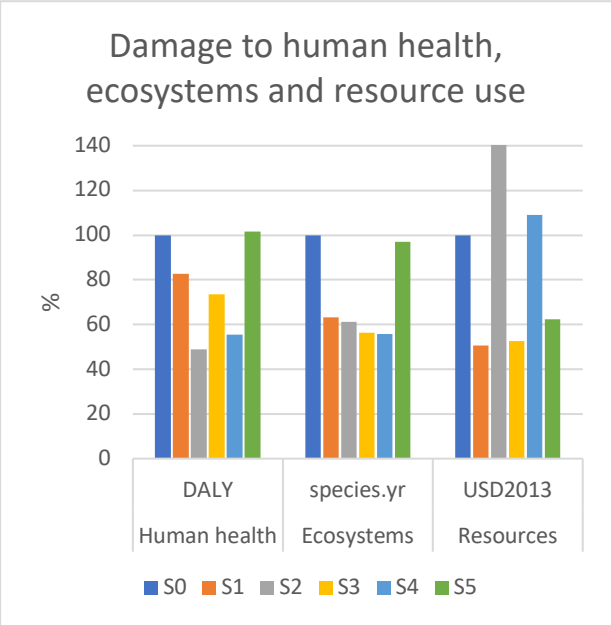
(Leach et al, Energies 2021, 14, 3371. https://doi.org/10.3390/en14123371)

Assumptions

Six different scenarios were analysed using the following assumptions: (a) access to electricity is synonymous with suitable supply to use electricity for cooking, (b) for rural population, if 61.9% have access and only 0.1% currently use electricity for cooking, then there is capacity for a further 61.8% of rural population to transition to electricity, (c) for urban population, if 90.8% have access and only 1.5% currently use electricity for cooking, then there is capacity for a further 89.3% of the urban population to transition to electricity.

- Base case, in 2019 (S0)
- Shift rural and urban charcoal users to electricity (S1)
- Shift rural and urban firewood users to electricity (S2)
- Shift urban charcoal and firewood users to electricity (S3)
- Shift rural charcoal and firewood users to electricity (S4)
- Shift rural and urban kerosene and LPG users to electricity, (S5)





The impacts evaluated were improvement in CO_2 emissions, effect on human health, ecosystems and resource use. These are defined as:

- **Human Health,** expressed as the number of year life lost and the number of years lived disabled. These are combined as Disability Adjusted Life Years (DALYs). The unit is years.
- **Ecosystems,** expressed as the loss of species over a certain area, during a certain time. The unit is years.
- **Resource scarcity,** expressed as the surplus costs of future resource production over an infinitive timeframe (assuming constant annual production), considering a 3% discount rate. The unit is USD2013.

FINDINGS

1) The effect of the cooking devices was seen to be negligible, and the results are dominated by the fuel type.
2) Scenarios S2 and S4 showed the greatest potential to reduce CO_2 emissions, shifting away from firewood use in both rural and urban locations (S2), and shifting rural populations to electric cooking (S4).
3) For damage to health, ecosystems and resource use, both S2 and S4 result in an increase in resource use, expected as wood is generally seen as a 'free' resource, sourced from existing wood cover. By contrast, a shift to electricity will require an increase in resource us as 10% of electricity production is supplied through oil.
4) Shifting kerosene and LPG users only shows benefits for resource use and little benefit in CO_2 reduction.
5) The results normalised against global damage shows that human health impacts are more significant than those for ecosystems or resources.

CONCLUSIONS

Whilst there are high electrification rates in both rural and urban populations, it is recognised that not all of these are suitable for use with electric cooking.

This assessment suggests that initial efforts should be guided towards either shifting firewood users in both rural and urban locations to electric cooking, or focussing on rural charcoal and firewood users to electricity.

The limited CO_2 benefits, human health and ecosystem impacts of switching from kerosene and LPG to electric cooking suggest that these users should not, at the current time, be the primary focus for transitioning to electric cooking.

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