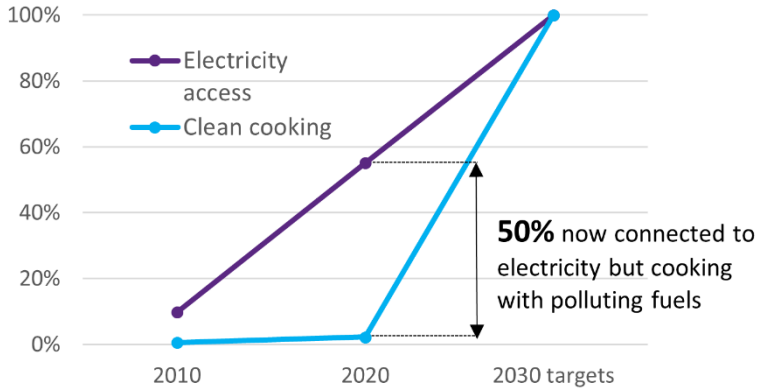
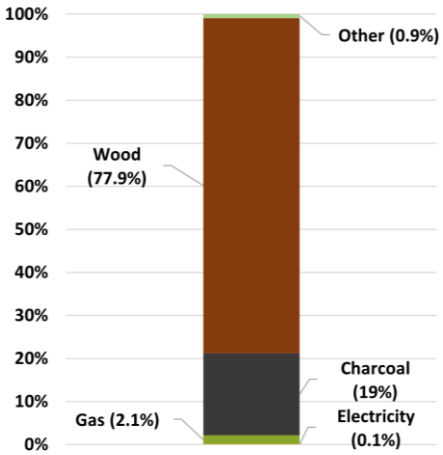
Modern Energy Cooking Brief: Rwanda

Current Situation: Electricity Access, Clean Cooking

- In 2022, 61% had access to electricity[1].
- In 2022, 17% cooked with commercialized polluting cooking fuels (charcoal); and 93% cooked with polluting cooking fuels (charcoal and wood)[2].

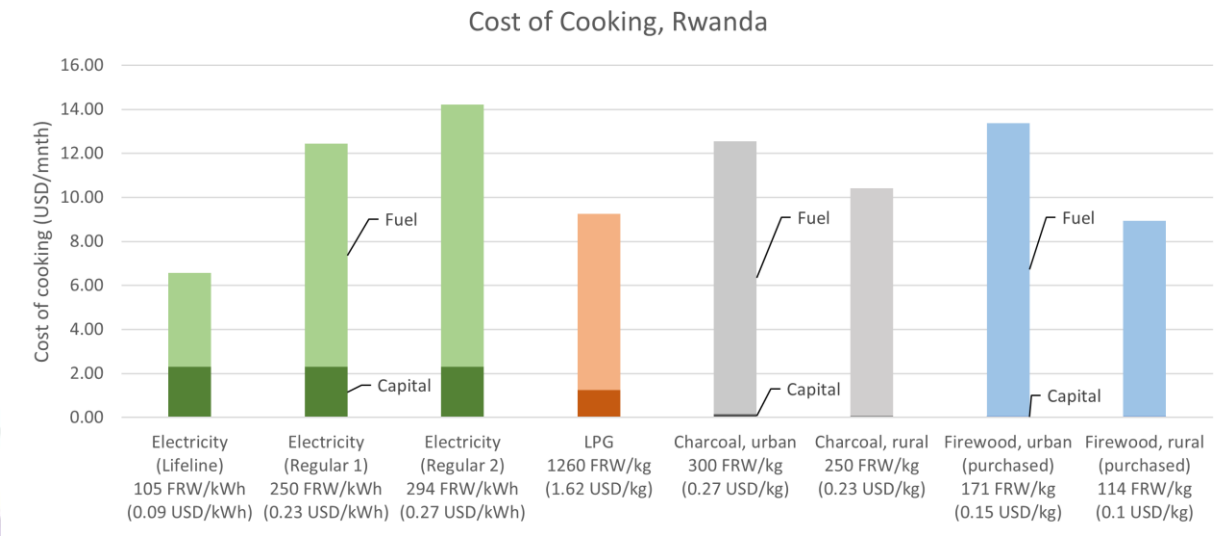




Above: Electricity and clean cooking access, Rwanda eCooking Market Assessment
Right: Primary cooking fuel use, Rwanda Market Assessment, data from 2020.

Potential for eCooking

- **50% of people are connected to electricity and not cooking with it** – urban centres can be easily targeted. More than 90% of households in urban areas are electrified and more than 65% use charcoal to cook[3].
- **Cooking with electricity on Regular 1 tariff is as expensive or cheaper in urban areas than cooking with biomass**, and it is safer and more convenient.



[1] NISR, 5th Population and Housing Census in Rwanda, 2022
[2] NISR, 5th Population and Housing Census in Rwanda, 2022
[3] MECS, Rwanda eCooking Market Assessment, 2022

Cost of cooking over a month, using international averages for cooking energy demand from ESMAP (2020)[4] and local electricity/fuel prices from price surveys conducted in 2021/2022, and including cost of appliance levelized over stove lifetime.

- **It is cheaper to cook with Electric Pressure Cookers (EPCs)**: 70% cheaper to cook beans on an EPC compared to charcoal, 50% cheaper compared to LPG[5].
- 90% of the menu can be cooked on EPCs[6].
- There is an expansion in electricity generation coming on board – 193 MW in 4 years[7] will create a generation surplus, and demand stimulation is a government priority.
- The Delagua Tubeho Neza project has given away 600,000 free Improved Cookstoves (ICS) and may repeat with a further 600,000. However, this activity can distort the commercial cookstove market and the utilisation of units may not be fully effective and efficient.

MECS programme activity

- Pilot projects run by Energy 4 Impact supported by MECS in February 2022.
- Electrocook, supported by EEP Africa and the Nordic Fund, was set up in 2020 with the mission to distribute 5000 Electric Pressure Cookers (EPCs). They are partnering with ARC Power to run a pilot with 50 households connected to one of ARC Power's mini-grids in Nyamata, Bugesera district. Electrocook's vision is to assemble EPCs in Rwanda in its quest to address supply chain issues and provide employment.

This material has been funded by UKAid from the UK government; however the views expressed do not necessarily reflect the UK government's official policies.

[4] Energy Sector Management Assistance Program. 2020. Cooking with Electricity: A Cost Perspective. World Bank, Washington, DC. © World Bank. License: CC BY 3.0 IGO.
[5] MECS, Cooking with electricity: Rwanda case study, 2023 [Unpublished]
[6] MECS, Cooking with electricity: Rwanda case study, 2023 [Unpublished]
[7] REG, Least Cost Development Plan 2022-2040, 2022

Rwanda: Socio-economic and environmental costs and benefits

Using the World Health Organisation's (WHO's) revised "Benefits of Action to Reduce Household Air Pollution" (BAR-HAP) tool, we **quantify the expected economic, social and environmental benefits of a simple scenario of uptake at scale of electric cooking for Rwanda**. The scenario represents a programme of eCook stove investment, with the capital costs paid by the programme (donor, investor or government funded) and housholds making savings in fuel costs and avoidance of buying replacement traditional stoves. In addition, the wider set of economic, social and environmental impacts can be calculated, and the sum of all costs and benefits, which is the overall 'social net-benefit' of this transition for Rwanda.

Scenario modelled: all households connected to the grid in Rwanda in 2020 but using charcoal as their primary cooking fuel transition to using an EPC by 2030.

The overall result is a very large economic benefit of the eCooking transition, with benefits shared between households and the wider society or country.

Details of the scenario assumptions and discussion of results are in the MECS Rwanda eCook market assessment. (Note some results are a little different here, due to changes in assumption since the market assessment).

Table. (A) households transitioning in the scenario; (B) Net social benefit of the transition per year; (C) financial costs of equipment, fuel and programme admin; (D) social and environmental benefits (in both physical units and then monetised)

(A) Grid connections projections and eCook target	Population (million)	Housholds (million)	
National population, 2020	12.63	2.96	
Grid connections, 2020	4.50	1.06	
Of which, using charcoal as main fuel	2.93	0.69	
Transition from charcoal to eCooking	1.17	0.27	
(costs are -ve, benefits are +ve)			**Monetised Costs & benefits, $/yr**
(B) Total present value (ie net social benefits of the transition)			**41,938,131**
(C) Total costs of transition, programme + household			**12,419,151**
Private cost to housholds: total			**15,983,066**
Stove			*108,630*
Fuel			*16,269,643*
Maintenance			*-395,207*
Costs to programme: total			**-3,563,915**
Stove			*-2,715,751*
Fuel			*0*
Admin			*-848,164*
(D) Health, Time, and Environmental Benefits: total		**Physical: change/yr**	**29,518,980**
Health impacts total: DALYs avoided	***Disability-adjusted Life Years (DALYS)***	**669**	**3,817,434**
Mortality reduction	*Years of life lost (YLL)*	*397*	*3,039,651*
Mortality reduction	*Lives*	*34*	
Morbidity reduction	*Years of healthy life lost (YLD)*	*272*	*777,783*
Morbidity reduction	*Cases*	*1,344*	
Time savings in cooking	**Hours**	**85,955,986**	**17,686,185**
Time savings per adopting household	*Hours/HH*	*318*	
Electricity use, additional	**MWh**	**189,194**	
CO2-eq reduction (CO2,CH4,N2O)	**Tonnes**	**433,465**	**6,618,431**
Unsustainable wood harvest reduction	**Tonnes**	**168,618**	**1,396,930**

Figure. Monetized costs and benefits from the table, and how these stack to a net social outcome over ten years.

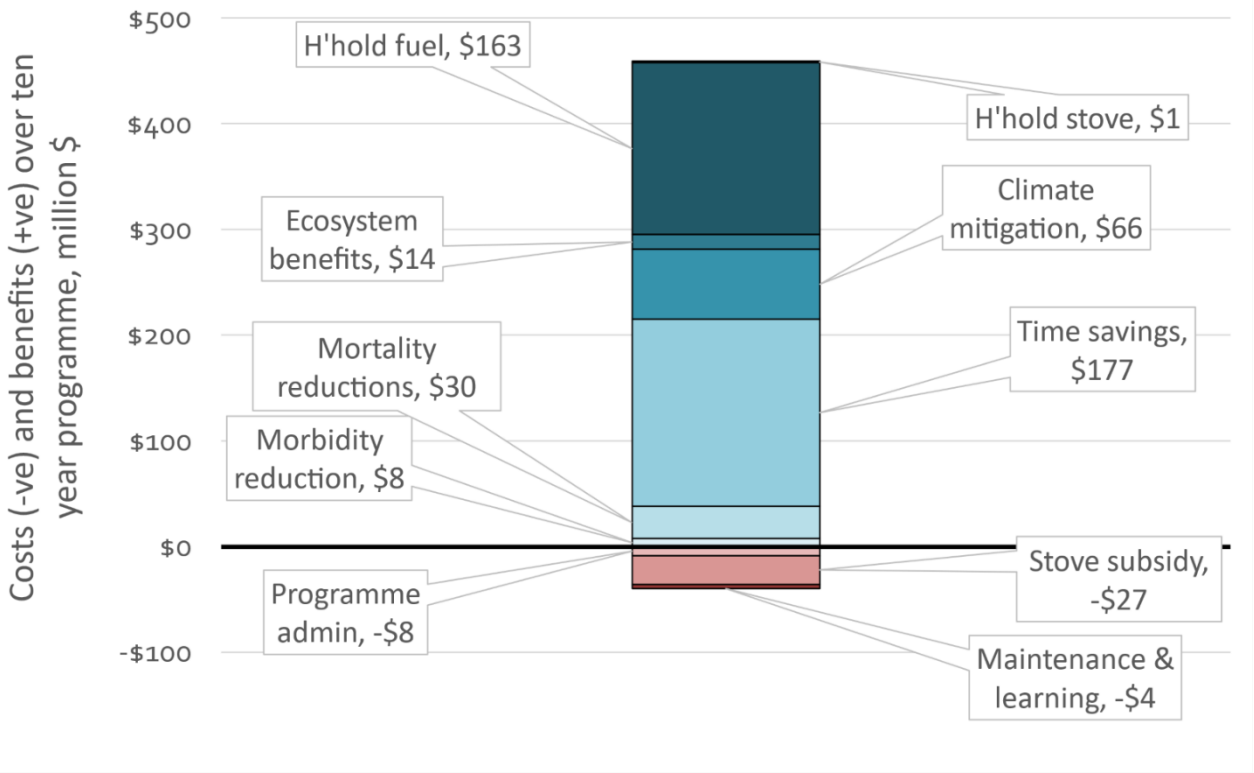


Table. Explanation of the physical impacts and their monetisation

Costs and Benefits	Physical effects	Monetisation of benefits
Morbidity (ill-health) reduction	Morbidity reductions of: chronic obstructive pulmonary disease (COPD); acute lower respiratory infections (ALRI); ischemic heart disease (IHD); lung cancer (LC); stroke (x)	The 'Value of statistical life' puts a monetary benefit to a year of life. Time lags are added to account for the time to develop illness, and a social discount rate is applied so the present value of these future health benefits are discounted. "Spillover" health benefits are also added, reflecting the improvements in outdoor air quality
Mortality reductions	Mortality reductions of: COPD, ALRI, IHD, LC, x	Multiplied by value of statistical life, and adding time lags and adding spillover benefits, as for morbidity
Time savings	Change in time spent cooking	Valued at a fraction of the unskilled market wage, to reflect the lower opportunity cost for time spent cooking relative to work time
Climate mitigation	Change in Kyoto protocol greenhouse gases (i.e. CO2, CH4 and N2O) plus three additional pollutants (BC, OC and CO)	Valued using a social cost of carbon
Ecosystem benefits	Change in unsustainably harvested firewood	Cost of timber farming multiplied by change in renewably harvested biomass
Household fuel	Electricity use and traditional fuel displaced	Fuel and electricity prices
Household stove	Avoided traditional stove replacements	Cost of traditional stove which is saved
Programme admin	Programme planning & implementation effort	Using local wage rates
Stove subsidy	eCook equipment required	Price of eCook stove
Maintenance & learning	eCook appliance maintenance + time for householders to learn eCooking	Maintenance costed using local wage rates; learning time costed using a fraction of the unskilled market wage

Loughborough University
ESMAP Energy Sector Management Assistance Program
UKaid from the British people