



Advancing Clean Cooking in Rural Households – A Global Perspective

Dr Rihab Khalid

STEER, Loughborough University

R.Khalid@lboro.ac.uk |  @rihab_khalid





About MECS

- **Modern Energy Cooking Services (MECS)** is an eight-year research programme funded by UK Aid (FCDO), working in close partnership with NGOs, governments, private sector, academia and research institutes, policy representatives and communities in 16 countries, with research studies conducted in +20 countries.
- The £40m MECS programme aims to **break out of the “business-as-usual”** cycle of developments on cooking by investigating how to rapidly accelerate a transition from biomass to genuinely ‘clean’ cooking (i.e. with electric or gas).
- By integrating modern energy cooking services into the planning for electricity access, MECS seeks to leverage investment in renewable energies (both grid and off-grid) to address the clean cooking challenge.

Clean Cooking

Clean cooking fuels and technologies are those that attain the fine particulate matter (PM2.5) and carbon monoxide (CO) levels recommended in the World Health Organisation (WHO) [global air quality guidelines \(2021\)](#).

Polluting Cooking fuels



Solid fuels



Kerosene



Biomass



Charcoal



Coal

Clean cooking fuels



Improved
biomass
cookstoves (ICS)

Modern energy cooking fuels



LPG



Electric / solar



Natural gas



Bio/ethanol



Biogas

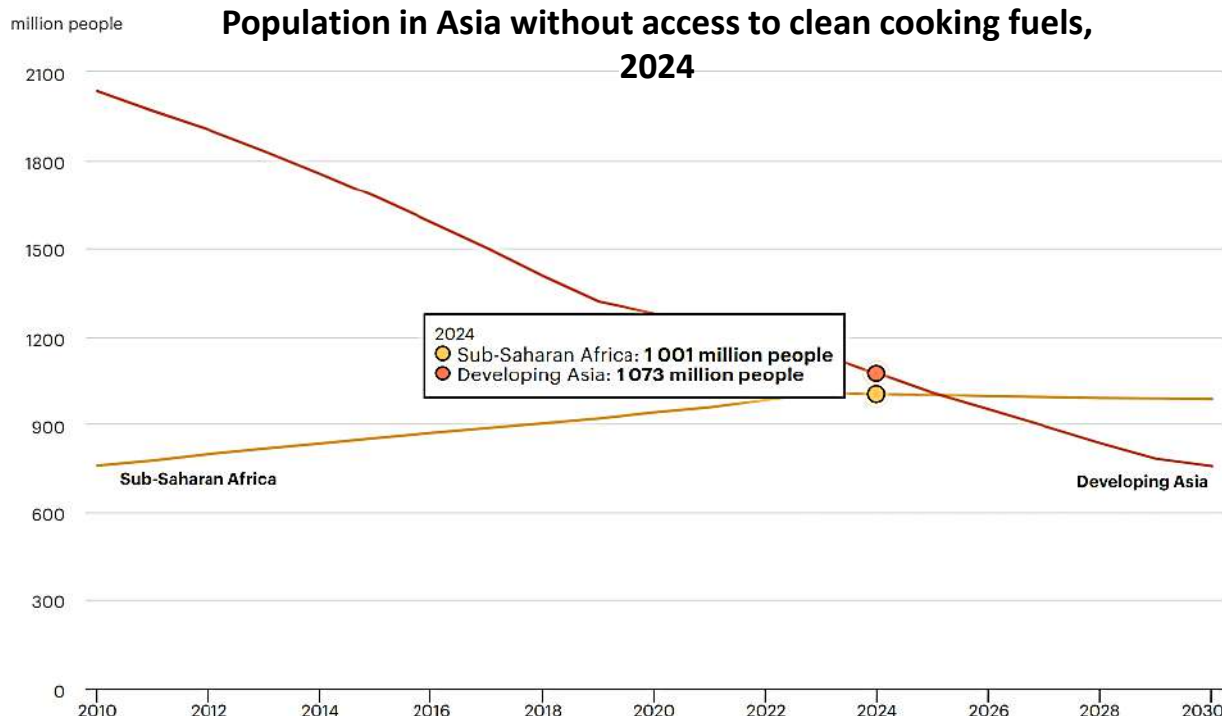


MECS

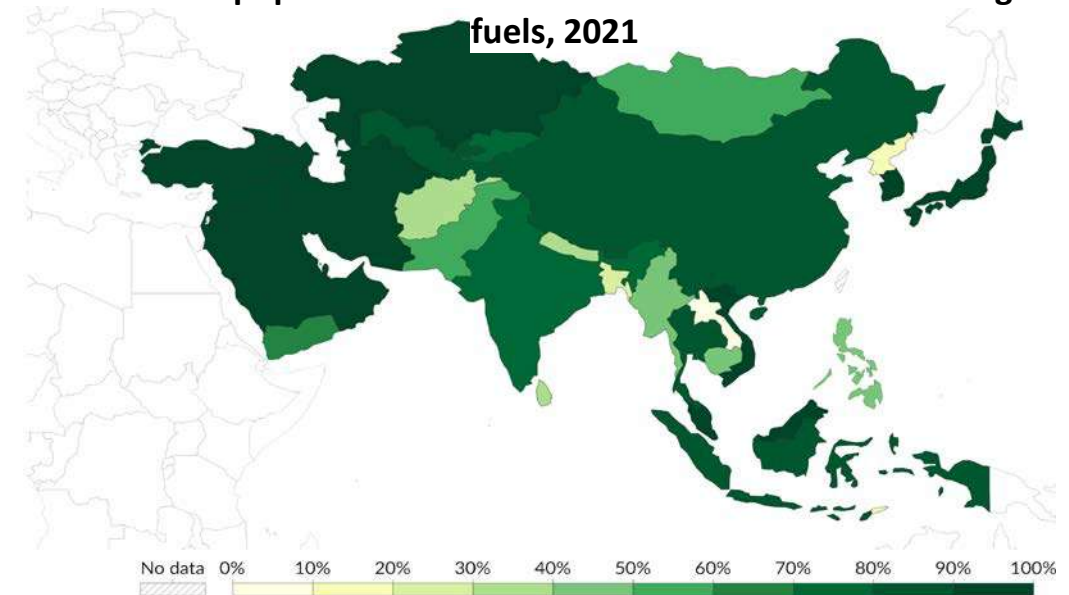
The Global Clean Cooking Challenge

- About **2.3 billion people** globally remain without access to clean cooking, relying instead on traditional and polluting energy sources like biomass, kerosene, and coal.
- About **1 billion people** in Developing Asia (27% of Asia's population) lack access to clean cooking facilities.

	INDICATOR	2010	LATEST YEAR
	7.1.1 Proportion of population with access to electricity	1.1 billion people without access to electricity	675 million people without access to electricity (2021)
	7.1.2 Proportion of population with primary reliance on clean fuels and technology for cooking	2.9 billion people without access to clean cooking	2.3 billion people without access to clean cooking (2021)



Share of population in Asia without access to clean cooking fuels, 2021



Data source: World Health Organization - Global Health Observatory (2024)

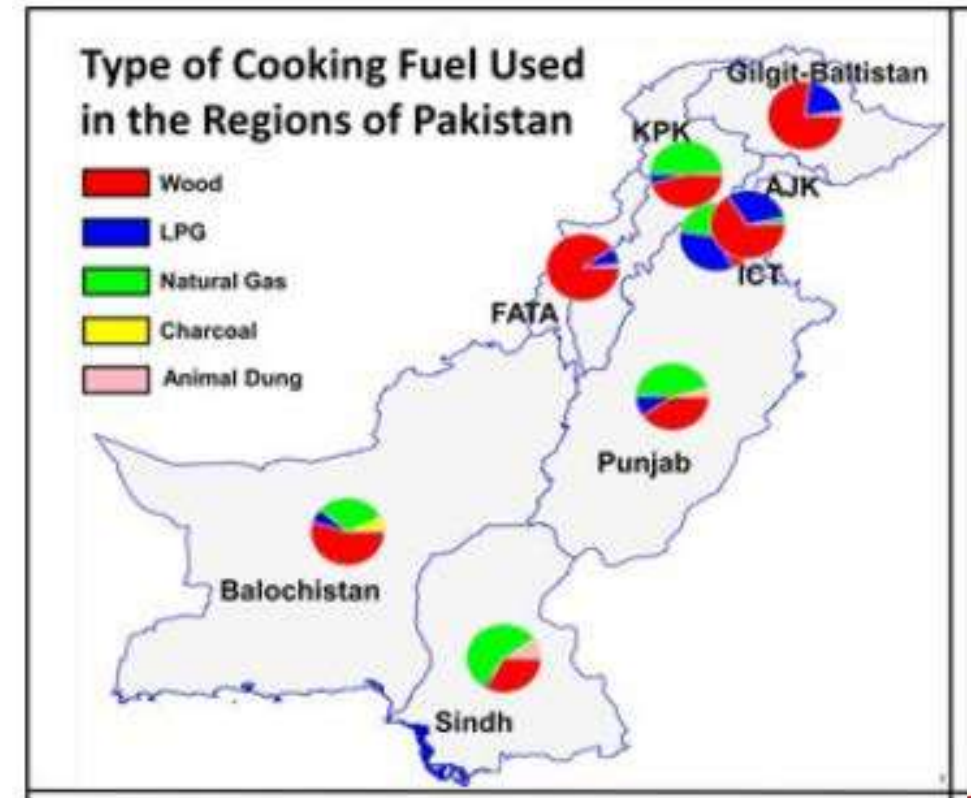
The South Asian Clean Cooking Challenge

- **The Rural-Urban Divide in Clean Cooking Access:** Percentage of rural population with access to clean cooking still remains significantly low in many South Asian countries

South Asia

Country	Most Recent Year	Most Recent Value
Afghanistan	2022	18.5
Bangladesh	2022	11.1
Bhutan	2022	81.4
India	2022	62.5
Maldives	2022	99.7
Nepal	2022	24.7
Pakistan	2022	31.3
Sri Lanka	2022	26.5

Rural population with clean cooking access in South Asia
(Source: World Bank datasets)





MECS

The Cost of inaction

The costs of continuing the current state of access sum up to **US\$ 791.4 billion** per year (MECS/ESMAP), calculated from the negative externalities of:

- **Health** - **US\$ 526.3 billion per year**
 - Broad range of health conditions associated with **household air pollution (HAP)**. **4 million** premature deaths annually due to household air pollution from inefficient cooking practices.
 - **Burns** suffered by household members cooking with traditional fuels and appliances.
 - **Chronic and acute physical ailments** that can occur during fuel collection.
- **Gender** - **US\$ 225.8 billion per year**
 - **Disproportionate effects** on women and young girls.
 - Physical ailments, injury, and **gender-based violence (GBV)** associated with fuelwood collection.
 - **Time poverty** (from cooking, fuel collection, and drudgery), with potential risk of lowered household status.
- **Climate** - **US\$ 39.3 billion per year**
 - **Greenhouse gas (GHG) emissions** due to the use of inefficient fuel production and consumption.
 - Catalytic warming effects of **black carbon (BC) emissions**.
 - **Forest degradation, deforestation** and **reduced agricultural production** due to fuel collection and production.





MECS

The Cost of inaction

The costs of continuing the current state of access sum up to **US\$ 791.4 billion** per year (MECS/ESMAP), calculated from the negative externalities of:

Externality	Cost (US\$, billions/year)				
	Sub-Saharan Africa	Latin America and the Caribbean	East Asia	Southeast Asia	South Asia
Health	96.3	21	729.4	174.1	423.5
Gender	186.2	59.8	178.9	89.2	321.9
Climate and Environment	47.5	5.9	35.5	15.4	66.6

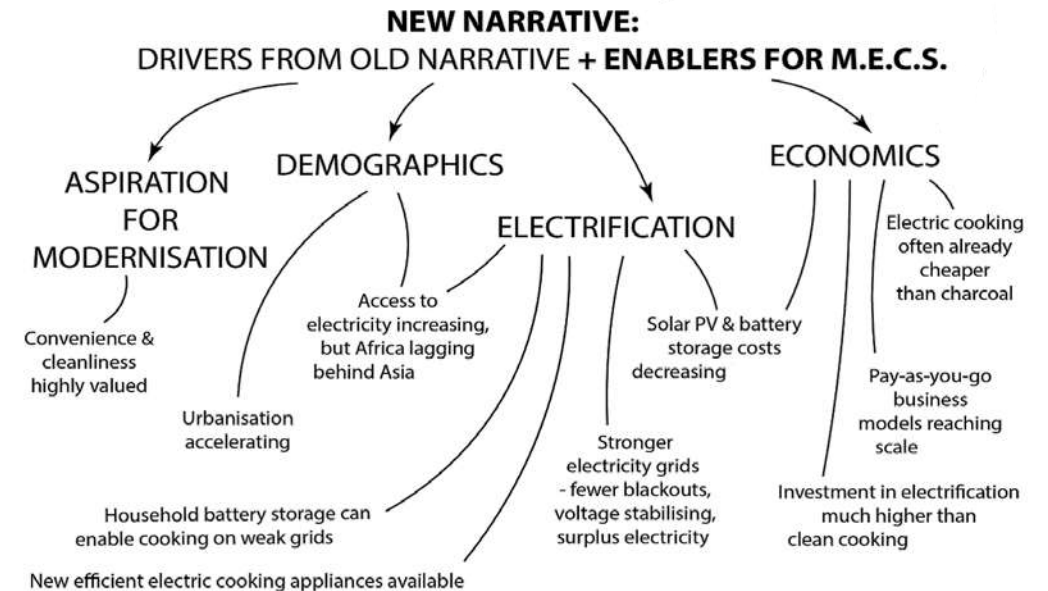
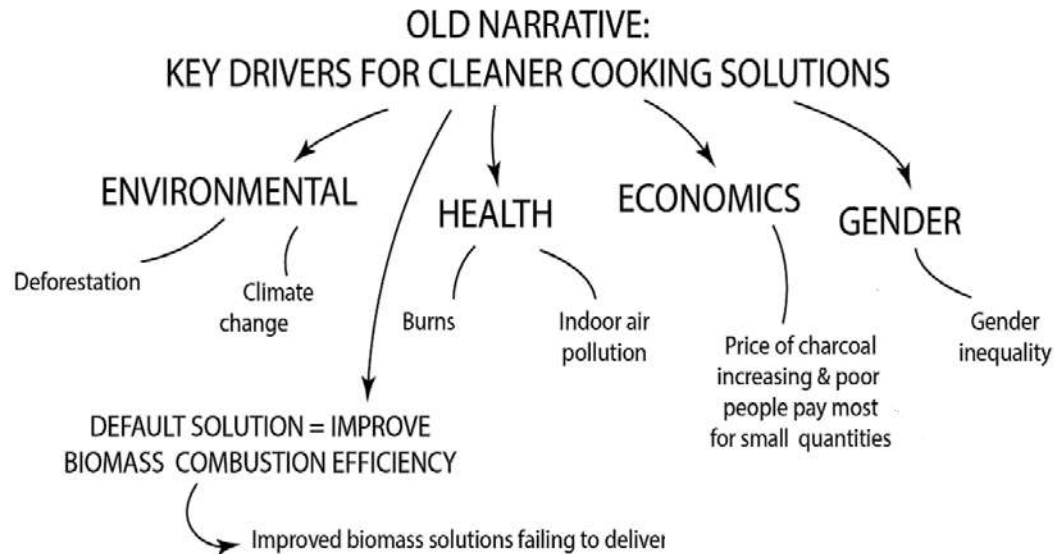
Source: ESMAP The State of Access to Modern Energy Cooking Services, 2020



Changing the clean cooking narrative

SDG7 = Universal energy access + Clean cooking ?

SDG7 + Energy security (electricity access + clean cooking) + Climate Action



- Transition from biomass to cleaner but still **fossil-based fuels**
- **Technological swap** rather than holistic energy solutions
- Inadequate in addressing **climate change** and **sustainability goals**.



- Shift from fuel switching to **integrated energy planning**
- **Renewable energy** and technological innovation
- Potential for significant reductions in GHGs and **achieving SDG7**

The Multi-Tier Framework for modern energy cooking services

- **SDG 7.1.2: access to clean fuels and technologies for cooking** is measured using a proxy of whether households cook primarily with “clean” fuels, using a binary approach.
- However, measurement of access needs to reflect a continuum of improvement that focuses not only on fuels but also other important attributes of the cooking system.



Holistic Criteria to Measure Access to Modern Energy Cooking Services

Exposure Personal exposure to pollutants, which depends on both stove emissions and ventilation (higher tiers indicate lower exposure)

Efficiency Combination of combustion and heat-transfer efficiency

Convenience Time spent collecting/ purchasing fuel and preparing the stove

Safety Severity of injuries caused by the stove over the past year

Affordability Share of household budget spent on fuel (higher tiers indicate lower share of spending)

Availability Readiness of the fuel when needed by the user

Transition to modern energy cooking services

LPG cooking

- Tier 4 fuel designated by WHO as safe and strongly beneficial in reducing carbon emissions and deforestation.
- Lessons from India, Indonesia, Morocco and Brazil on taking LPG to scale.
- Well-accepted with greater cultural preference.

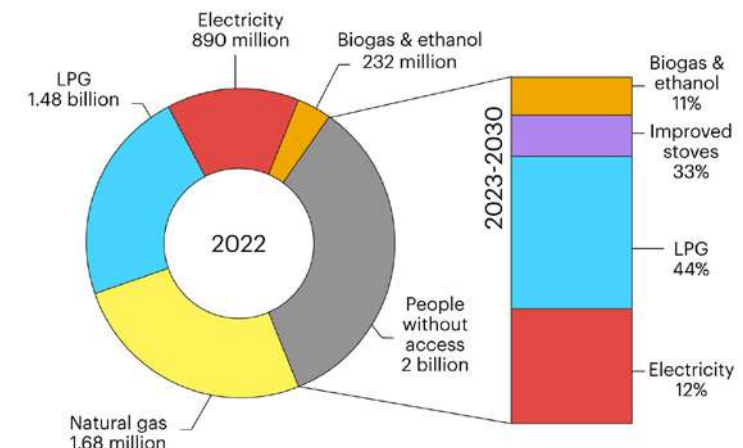
Key markets	Urban and Peri Urban (+ densely populated rural).
Distribution mechanisms	Local agents, sellers or shops – specialised infrastructure is required to ensure cylinder reticulation by seller and safety checks with refills.
Positive attribute	Potentially a flexible clean cooking experience. Minimal kitchen-based emissions (Tier 5). Fits the mindset of 'going to the market to get food and other things'.
Negative aspect	Often an import with associated drain on foreign exchange. Price subject to global commodities trading. Sometimes it requires subsidies to price compete with alternatives like charcoal. Refilling even with subsidies has chequered history. Some safety concerns by consumers.
Constraints	Requires investment in processing plants, storage and distribution networks, with regular secure flows.

Source: AFREC report

<https://www.worldbank.org/en/topic/energy/publication/the-state-of-access-to-modern-energy-cooking-services>

Electric (solar) cooking

- Electric cooking using: national grid electricity, **mini-grid electricity, and stand-alone systems.**
- Tier 4 and 5 cooking with no household emissions.
- Electricity expected to become **12%** of the clean cooking fuel mix by 2030 (IEA, 2023).
- eCooking based on renewable energy supply such as Solar PVs has minimal climate impact, except during the manufacturing of the system.



Current challenges of scaling up eCooking



Infrastructure Limitations

- Inadequacies in current electrical grid to support widespread high-power e-cooking adoption.
- Distributional differences between countries.
- Rural–Urban divide: Rural areas with limited access to reliable electricity.



Market barriers

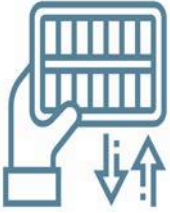
- Fragmented energy planning, high taxes and misaligned tariffs codes hinder industry growth.
- Supply shortages, and supply and logistical barriers.
- Dependency on imported technologies increases costs and reduces market responsiveness to local needs.



Cultural and Behavioural Barriers

- Lack of awareness about the benefits of e-cooking solutions and low social acceptability
- Low perceived benefits of transitioning to modern cooking technologies.
- Preference for traditional cooking methods.
- Technologies not well-adapted to local cooking habits and energy availability.
- Durability and maintenance requirements.

Current challenges of scaling up eCooking



Data & Energy Modelling

- Clean cooking modelling remains nascent in many contexts.
- Simplified assumptions of cooking demand.
- Scarcity of available eCooking data and lack of consideration for wider range of eCooking appliances.



Financial barriers and credit constraints

- Upfront costs of ecooking technologies often beyond the reach of low-income households. Poor households often face liquidity constraints.
- Lack of accessible financing options such as micro-loans, subsidies, or pay-as-you-go models that can facilitate the adoption of clean cooking technologies.



Regulatory frameworks & institutional coordination

- Clean and modern energy cooking not consistently integrated into national energy strategies or climate action plans.
- Inadequate policy support and absence of regulatory frameworks.
- The clean cooking mandate sits across multiple ministries of government resulting in disconnected and fragmented approaches.

Future Opportunities and Strategic Directions



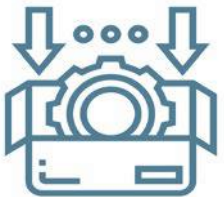
Innovation and Research

- Continued innovation in appliance efficiency and adaptability to various energy sources.
- Research into consumer behaviour to better tailor products to Asian markets.
- Geospatial modelling & eCooking planning tools.
- dMRV and IoT in ecooking appliances for accurate consumer cooking use and practices.



Investment and financing

- Innovative financing models, like pay-as-you-go systems, carbon financing, Results Based Financing, carbon credits, green impact bonds and cook2earn finance models.
- Institutional cooking/anchor clients as 'stepping stones'.
- Lower tech costs: panels, appliances.



Market Development:

- Significant market potential for e-cooking solutions in urban/peri-urban areas.
- Moving manufacturing chains to South Asia and promoting partnerships between international manufacturers and local agents/distributors to improve availability and affordability of high-quality appliances.

Future Opportunities and Strategic Directions

Co-benefits



- Leveraging clean cooking transition to harness co-benefits, e.g., improved health, gender equity, climate and environmental benefits.
- Links to sustainable livelihood and job creation.

Multi-fuel clean cooking strategy



- Considering full spectrum of clean and sustainable solutions, spanning improved biomass tech + MECS.
- Integrated energy planning that consider electrification and clean cooking.

Coordinated and coalition for MECS



- Coordination among various ministries, agencies, and utilities to align efforts and share resources effectively, similar to successful electrification efforts in countries like Kenya, India, and Rwanda.
- Utilize the convening power of regional entities like ASEAN and SAARC to coordinate clean cooking efforts continent-wide, enhancing advocacy, nurturing political will, and ensuring sustainable progress.



Holistic multi-pronged approach – MECS Jigsaw

MECS Policy Enabling Environment

Policy landscape reviews, SWOT analysis



Modern Energy Cooking Services research praised at Ministerial Thematic Forums Side Event



Introducing eCooking Tariffs

Developing standards



National eCooking strategies

METHODOLOGY

METHODOLOGY FOR METERED & MEASURED COOKING DEVICES

SDG 13

Publication Date 13/12/2022



Engagement Group Members to date



Electric cooking - from niche technology to mainstream living

Consumer Awareness

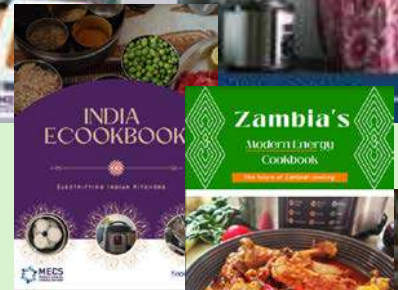
Country eCookbooks



Learning to Cook through time among different generations in Cambodia



Learning to cook reports



Cooking diaries

MECS gender framework



eCooking Awareness raising exhibitions



Supply Chain

Ecoking global market assessments



Repair and maintenance studies

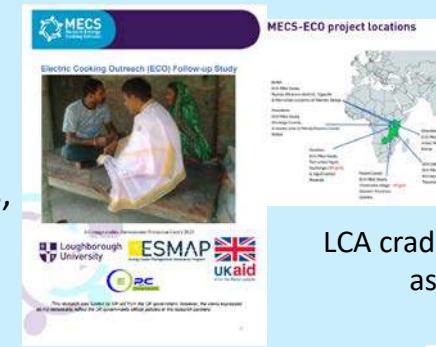


SC2 challenge funds

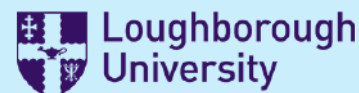
Utility-led EPC pilots

Infrastructure adaptability funds

TRIID challenge funds, ECO challenge funds, LEIA challenge funds



LCA cradle to cradle assessments



MECS initiatives - Policy enabling environment

Policy support

- Kenya's Ministry of Energy national eCooking Strategy.
- Uganda 2020 Development Plan and Energy Policy.
- PEEDA's MECS research and Nepal NDC's implementation plan.
- India's Entrepreneurship Development Programme (EDP) .

Standardization support

- Development and approval of the Gold Standard Metered Methodology for carbon credits, specifically designed for modern energy cooking devices, in partnership with ClimateCare.
- A methodology that allows for the efficient and accurate quantification of emissions reductions from the use of electric and other metered cooking devices, through dMRV and IoT.

eCooking Tariff

- Active support to the Nepal Electricity Authority in the introduction of a dedicated eCooking tariff as part of a broader initiative to promote eCooking in 100,000 households.



METHODOLOGY

METHODOLOGY FOR METERED & MEASURED ENERGY COOKING DEVICES

SDG 13

Publication Date 13/12/2022

MECS initiatives – Consumer Awareness

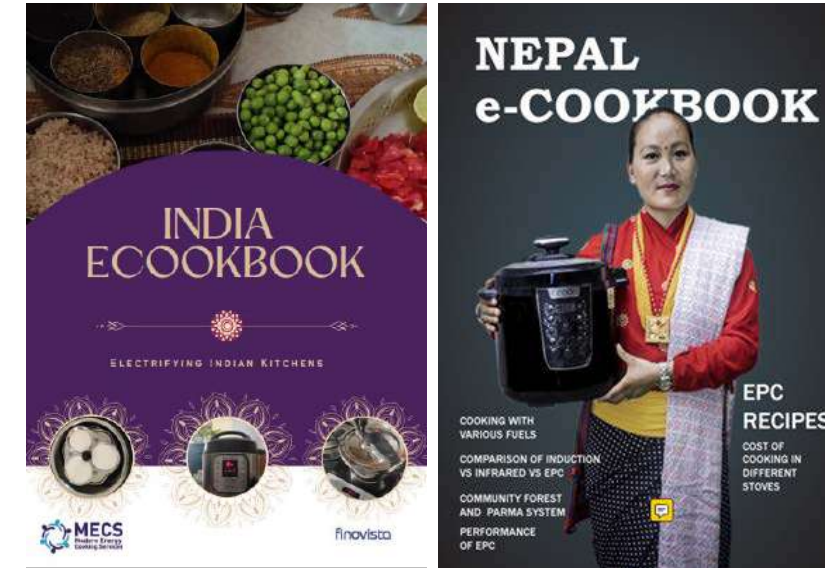
eCookbooks:

Capture unique opportunities for transitioning to modern energy in each country context

- India eCookBook highlights value of EPCs and induction stoves for cooks further electrifying their kitchens.
- Zambia eCookBook focuses on reducing loads on the grid.
- Uganda eCookBook focuses on the huge cost and time savings of eCooking in comparison with charcoal.
- Nepal eCookbook raises awareness of health, social and particularly cost saving benefits of eCooking compared to LPG and firewood.

Cooking diaries:

Considering full spectrum of clean and sustainable solutions, spanning improved biomass tech + MECS.





MECS initiatives – Supply Chain

Global Market Assessment

- Provides score on the viability of electric cooking scale up from 37 indicators
- 130 countries in the Global South.
- Provides a score for national grid, mini-grid and off-grid (standalone) supported eCooking.
- Online tool allows users to change individual indicator weightings, and explore all data sets (<https://gma.mecs.org.uk/>)

Electric Cooking Outreach (ECO) Pilot Studies:

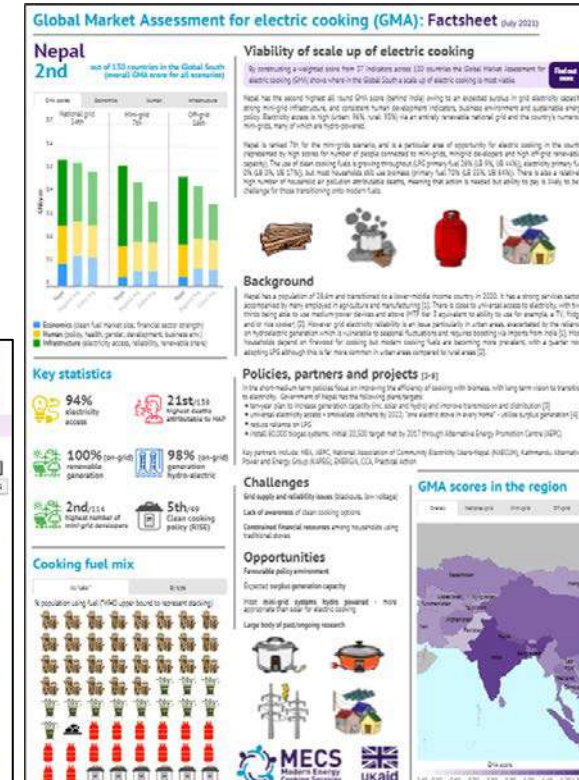
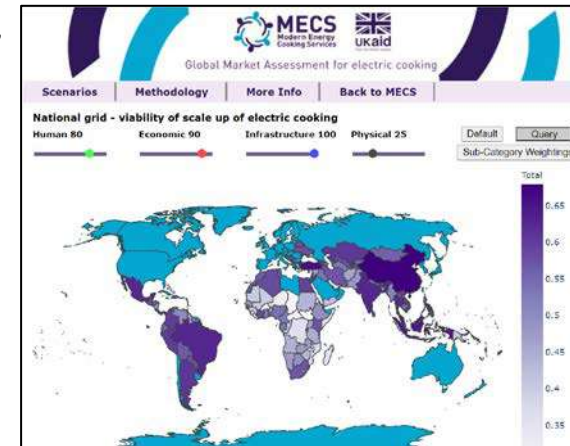
- Assessment of long-term impacts of ecooking
- Follow-up studies to gauge acceptance and use of ecooking over time.

Cooking Support on Mini-Grids (COSMO) Challenge Fund:

- Integrating ecooking solutions with existing mini-grid infrastructures
- Improving viability and affordability of ecooking solutions in off-grid contexts.

STARSS Challenge Fund Competition (Standalone or rooftop solar systems inclusion of eCooking)

- Recent call, project proposals under review.



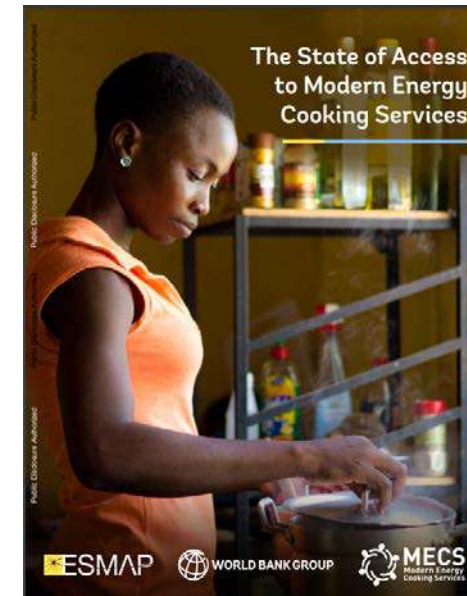
MECS Challenge Fund. PEEDA: Assessing electric cooking potential in micro hydropower microgrids in Nepal.
<https://mecs.org.uk/download-category/mecs-triid-report/>



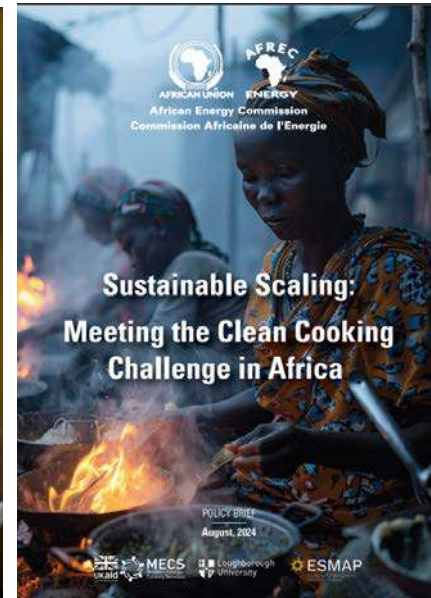
Thank you

Further info on the MECS programme

- Visit the [MECS website](#) to access the Publications repository, latest news releases, blogs, and more.
- [Subscribe](#) to the MECS newsletter to receive summaries of the latest news, activities and publications to your inbox.
- Follow the latest updates from the MECS team and partners on [Twitter](#).
- Follow me on [LinkedIn](#)



<https://www.worldbank.org/en/topic/energy/publication/the-state-of-access-to-modern-energy-cooking-services>



<https://mecs.org.uk/resources/afrec-report/>

