Project concept

A path to health, sustainability and development: Accelerating access to clean cooking through conformance to international standards

Edition 1.0: 2024-12

Published 3 December 2024

This foundational document may accompany the Call for Expressions of Interest for projects of the IEC Global Impact Fund. The IEC solicits feedback on its contents from all interested stakeholders. The document will be maintained online and updated based on ongoing exchanges.

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Problem statement

Global challenges such as ending poverty, food insecurity, ensuring healthy lives for all and protecting the environment are deeply interconnected. The United Nations recognizes that universal access to affordable, clean and sustainable energy is critical for the wellbeing of people and the planet. Global electrification enables both energy efficiency and the reduction of greenhouse gases. It also fuels economic activity, social development, and helps to reduce pollution. Electrification directly contributes to the United Nations' seventh Sustainable Development Goal (SDG) which aims to "ensure access to affordable, reliable, sustainable and modern energy for all" and indirectly to other SDGs. Sustainable electrification must be accelerated and coordinated to reach global climate targets.[1]

The International Electrotechnical Commission (IEC)

The IEC is a global, not-for-profit membership organization that brings together almost 170 countries and coordinates the work of more than 20 000 experts globally. IEC Standards are voluntary and, because they are reached by consensus, they foster collaboration and cooperation among a broad range of stakeholders. The diversity and inclusivity of the IEC process means international standards are aligned with the needs of stakeholders all over the world – Africa, Asia, the Americas, Europe and Oceania.

IEC Standards provide instructions, guidelines, rules or definitions to enhance safety and efficiency of electric, electronic and information and communications technology (ICT). These are then used to design, manufacture, install, test and certify, maintain and repair electrical, electronic and ICT devices and systems. IEC International Standards and conformity assessment work underpins international trade in electrical and electronic goods. It facilitates electricity access and verifies the safety, performance and interoperability of electric and electronic devices and systems, including, for example, consumer devices such as mobile phones or refrigerators, office and medical equipment, information technology, electricity generation, and much more. The IEC makes critical contributions to global trade, the environment, cyber security, digitalization, energy efficiency and the future of business and technology.

Conformity assessment (CA) refers to any activity that determines whether a product, system, service and sometimes people fulfil the requirements and characteristics described in a standard or specification. Such requirements can include performance, safety, efficiency, effectiveness, reliability, durability or environmental impacts such as pollution or noise. Verification is generally done through testing and/or inspection. Through its CA Systems, the IEC also provides a framework that enables testing to be transparent, predictable, comparable, and affordable.

IEC International Standards and CA Systems provide the foundation that allows countries to put in place sustainable, resilient quality infrastructure (QI) to stimulate economic development and innovation and apply global best-practices to manage safety, quality and risk. They enhance access to technology and innovation, promote the development, transfer and dissemination of environmentally sound technologies, and facilitate participation in global value chains and world trade.

The IEC Global Impact Fund

The IEC Global Impact Fund advances the IEC vision for "*a safer and more efficient world*" and demonstrates the catalytic impact of international standards and CA Systems in addressing many of today's social and environmental challenges. As a reflection of this commitment, the IEC launched the Fund through a three-year annual contribution of 1% of its Capital & Reserves over the 2023-2025 pilot phase. This seed funding is helping to build a global partnership aligned with the IEC values and mission.

The Fund's mission is to promote the application of international standards and conformity assessment systems by small and medium enterprises (SMEs) and positively impact the capacity of IEC Members and Affiliates to

[1] www.enerdata.net/publications/executive-briefing/world-electrification-decarbonisation.html

sustainably address global environmental, social and economic challenges. This will allow the Fund to help drive the critical need for a coordinated consensus-driven approach to electrification and avoid the fragmentation that will perpetuate barriers to the green energy transition. As a platform for collaborative partnerships, the IEC envisages that each project will involve multiple partners, including NCs/Affiliates[2], SMEs and other partners either directly or indirectly involved in implementation. The first project of the Fund, *Catalyzing innovation for circular models – Turning battery e-waste into e-resources,* led by an SME in rural Kenya, is using second-life batteries to bring inoperable solar panels back to life – helping rural communities while promoting sustainable battery e-waste management. The results will empower local people and have a far-reaching impact. The second project of the Fund will focus on the area of clean cooking in Asia.

1. Project introduction

The problem: Global cooking practices and their consequences

In many parts of the developing world, traditional cooking methods rely heavily on solid fuels like wood, charcoal and animal dung. These methods are not only inefficient but also dangerous. According to the World Health Organization (WHO), around 2,4 billion people, roughly a third of the global population, still rely on such fuels. The use of biomass fuels in open fires or inefficient stoves leads to several major issues:

- ✓ Health hazards: The burning of solid fuels releases harmful pollutants such as carbon monoxide, particulate matter and other toxins. Prolonged exposure to these pollutants is linked to respiratory illnesses, cardiovascular diseases and cancer. According to the WHO, around 3,8 million premature deaths annually are attributable to household air pollution caused by such cooking methods.
- ✓ Environmental degradation: Large-scale use of firewood and charcoal contributes to deforestation, land degradation and biodiversity loss. It also exacerbates climate change by releasing significant amounts of carbon dioxide and black carbon into the atmosphere.
- ✓ Social and economic impacts: The task of collecting firewood, which often falls on women and children, consumes significant time and energy. In regions with high fuel scarcity, families may spend several hours per day collecting fuel, limiting opportunities for education and economic activities.

The need for cleaner, more sustainable cooking solutions at scale is clear and urgent.

The opportunity: Societal and economic benefits of clean cooking solutions

The transition to clean cooking technologies brings a myriad of benefits that extend beyond improved cooking efficiency.

- ✓ Health benefits: Clean cooking technologies, such as electric stoves, eliminate household air pollution, reducing the risks of respiratory diseases, heart conditions and cancer. By reducing exposure to harmful pollutants, clean cooking solutions can prevent millions of premature deaths each year, particularly among women and children who spend more time near stoves.
- ✓ Gender equality and empowerment: Women, particularly in rural areas, are disproportionately affected by traditional cooking methods. Clean cooking technologies reduce the time and physical burden of fuel collection, giving women more time to engage in productive activities such as education, income generation, and community involvement. It also enhances gender equality by creating opportunities for women to participate in energy-related enterprises.

[2] NCs – National Committees – are the IEC Members; there is only one per country and each NC gathers all public and private sector interests relevant to IEC work. Affiliates are developing countries who benefit from support to develop their national quality infrastructure; they participate in IEC work free of cost.

- ✓ Environmental sustainability: Clean cooking reduces deforestation and the depletion of natural resources. Furthermore, cleaner energy sources, such as electricity or liquefied petroleum gas (LPG), produce fewer greenhouse gas emissions than biomass fuels, contributing to climate change mitigation.
- ✓ Economic growth: Cleaner cooking methods can generate economic opportunities by fostering the development of local supply chains, service industries and entrepreneurship. Households that switch to efficient cooking technologies save money on fuel in the long run, which can contribute to poverty alleviation.

2. The context

There is an urgent need to decarbonize and mitigate the devastating consequences of the climate crisis. While significant progress and investment has been made in infrastructure and access to electricity in the last decade, these gains are sometimes disconnected from the enduring problem of clean cooking – every cent invested in a strong electrical grid is also potentially useful for clean cooking. The increase in electrification rates over recent years are now opening up opportunities for electric cooking (eCooking). Asia now has relatively high electricity access rates and some countries in Africa, for example Kenya and Ghana, are now above 75%.[3]

Current state-of-the-art research[4] covers several clean fuels; however, the evidence points to the viability, cost-effectiveness and user satisfaction that energy-efficient eCooking[5] provides. Users are also becoming producers as both grid and off-grid systems become decentralized with mini-grids and solar home systems already forming part of the solution to increasing access. Additionally, there have been significant gains in the energy efficiencies of cooking devices, making cooking with electricity cost-effective in many contexts and saving households resources. Cooking with electricity is cost-effective for small business food processing, institutions and humanitarian contexts. Importantly, political commitments to solve the enduring problem of clean cooking are growing.

Quality infrastructure

The International Network on Quality Infrastructure, of which IEC is a member, defines quality infrastructure (QI) as the collective term used to describe metrology, standardisation, conformity assessment, accreditation and market surveillance activities. It denotes the ecosystem of public and private institutions together with the policies, relevant legal and regulatory framework, and practices needed to support and enhance the quality, safety and environmental soundness of goods, services and processes. In national contexts, QI enables the interoperability and compatibility of products fostering fair competition, facilitates verification of product quality, as well as ensuring substandard and unsafe products are withdrawn from the market. In the international sphere, QI facilitates entry into foreign markets which require goods and services to comply with designated standards. Developed countries have robust QI systems with emerging markets and developing economies (EMDEs) generally with less mature QI systems. Minimum Energy Performance Standards (MEPS) are often highlighted as an important stride in strengthening the QI system.

Supply chains and manufacturing hubs

By fostering local manufacturing and supply chains, countries can reduce costs, stimulate local economic growth, and increase the adoption of clean cooking solutions. Scaling up clean cooking initiatives requires a robust and efficient supply chain, from the manufacturing of cooking appliances to their distribution and maintenance. A well-functioning supply chain ensures that the right products reach the right markets at affordable prices. Key components include:

[3] IEA
[4] Modern Energy Cooking Services programme, Brochure, 2022.
[5] eCooking is considered clean for end users regardless of the mix of primary energy sources used for electricity generation, in line with WHO's definition of clean cooking. However, it is widely recognized that renewables-powered eCooking offers the most environmental benefits (IRENA 2024).

- Manufacturing hubs: Establishing local or regional manufacturing hubs for clean cooking appliances can reduce costs and create jobs. These hubs can stimulate local economies while reducing the dependency on imported stoves and appliances, which can be prohibitively expensive for consumers in developing countries. Manufacturing hubs also provide opportunities for innovation tailored to local cooking needs and preferences.
- Distribution networks: A reliable distribution network ensures that clean cooking solutions reach remote and underserved areas. This includes transportation infrastructure, as well as retailers and sales agents who can provide consumers with information and financing options.
- After-sales service: To sustain long-term adoption, households need access to after-sales support, including maintenance, repairs and spare parts. This requires a trained workforce and a service infrastructure that can operate in remote locations.
- Supply of electricity: In the case of eCooking, the supply chain for clean cooking fuel is the supply of electricity. Whilst this previously used to be from centralized grids or diesel generators, limiting the applicability of eCooking to wealthy and/or urban consumers, the emergence of solar home systems sized for cooking, mini-grids designed to support cooking loads and household energy storage to buffer unreliable grid supply, has enabled eCooking to become a much more equitable solution to the clean cooking challenge.

Financing and digitization

It is indispensable for the private sector to access the required capital through lending and equity instruments – the monetization of impact. The democratization of digital monitoring, reporting and verification platforms, standardization of metering, Internet of Things (IoT) cooking devices and digital business models present an unprecedented opportunity to both enhance market knowledge through improved data generation and collection, and leverage emerging carbon methodologies relying on digitalization.[6] A key opportunity is around carbon credits and the need for digital monitoring, reporting and verification (dMRV) systems to work well.[7]

3. Project background

Universal electrification, clean cooking and energy access

Over the last 10 years, eCooking, which encompasses electric pressure cookers (EPCs), electric hot plates, infrared or induction hobs, and other appliances (e.g. rice cookers, air fryers, electric ovens, etc.), has received increasing recognition as a feasible clean cooking alternative for electrified households in low- and middle-income countries (LMICs).[8] This growing recognition has been in parallel with the strong push towards more power generation through renewable energy (RE) sources, such as solar, wind, geothermal energy or hydropower. Progress in recent years has seen added renewables-based capacity reaching historical highs, with the share of renewables in total capacity expansion standing at 83 percent in 2022, up from 78 percent in 2021.[9] Where power predominantly comes from renewable sources, eCooking becomes one of the cleanest low-carbon cooking solutions available.[10] The market of eCooking solutions and technologies in LMICs has also been growing steadily, offering an ever-wider range of eCooking appliances at decreasing costs, making it more affordable for households to transition away from harmful and polluting cooking. As demonstrated by the World Bank's Energy Sector Management Assistance Program (ESMAP) and the Modern Energy Cooking Services (MECS) programme (2020), the use of energy efficient eCooking appliances in LMICs can be cost-competitive with more common alternatives

[6] Integrating Clean Cooking into National Energy Access Planning Tools and Considerations for Planning and Implementing eCooking
[7] A review of the standards, methodologies, technical needs and available resources related to digital monitoring, reporting and verification for modern cooking devices in the context of carbon finance, 2023, Loughborough University / ESMAP mecs.org.uk/wp-content/uploads/2024/03/MECS-MMECD-Report-v7-FINAL.pdf
[8] Brown et al. 2017; Batchelor et al. 2019; ESMAP 2020; Batchelor et al. 2022; Sánchez-Jacob et al. 2021
[9] IRENA 2023
[10] IRENA 2023

such as charcoal or liquefied petroleum gas (LPG), challenging the widespread perception of electricity being too expensive to cook with.[11]

eCooking is at the heart of the integration of access to electrification and clean cooking. Universal electrification initiatives have considered linkages with clean cooking too rarely and inconsistently. This may be due to a lack of awareness amongst the stakeholders involved, absence of supporting strategies and plans bridging the two, and limited opportunity (and ability) to deploy available funding to both electrification and clean cooking access simultaneously. Integrated energy planning has increasingly been considered as a key solution to tackling this sectoral divide. A well-designed integrated energy plan can help achieve energy access goals more efficiently, as it considers all resources and mechanisms needed for the provision of all energy needs, including electrification and access to clean cooking in a joint manner, leveraging the synergies between the two and considering the challenges from the start.[12] Electricity is a crucial component of modern clean cooking solutions. Electrification enables households to use clean, efficient cooking devices such as induction cooktops, electric pressure cookers and infrared stoves. The advantages of electricity-based cooking solutions include:

- Efficiency: Electric stoves are far more efficient than biomass or fossil fuel-based stoves. They convert a higher percentage of energy into heat, reduce heat loss to the surroundings through a variety of mechanisms including insulation, automation and pressurization and reduce both the cooking time and energy consumption.
- Sustainability: When powered by renewable energy sources like solar, wind or hydropower, electricity-based cooking methods are virtually emissions-free. The electrification of cooking, combined with a renewable energy grid, represents one of the most sustainable long-term solutions for reducing household carbon footprints.
- Ease of use and versatility: Electric stoves and cooking appliances are easy to use, offer automation, precise temperature control, and are versatile for a variety of cooking methods. These factors improve cooking quality, reduce the risk of kitchen accidents and enable multitasking.

However, the widespread adoption of electric cooking solutions depends heavily on reliable access to electricity. Thus, it is vital to continue expanding electrical infrastructure, especially in rural areas where access often remains limited. Importantly, infrastructure can now come in a plurality of forms and clean cooking can also act as a key driver for the expansion and strengthening of electrical infrastructure by creating demand for power and ensuring a return on investment.

The role of standardization

Standardization is essential in ensuring the quality, safety and performance of clean cooking technologies. Without standards, there is a risk of low-quality products flooding the market, which could undermine consumer confidence and hinder adoption. Standards can encourage/incentivize the supply of products that are reliable in the market context and can be repaired/maintained by locally trained technicians, in order to minimize e-waste and the unwillingness of customers to invest in expensive items. Enforcement of warranties can also play a role here, as can the development of maintenance networks/trained technicians. Key areas where standardization plays a critical role include:

- ✓ Health and safety standards: Stoves and appliances must meet stringent health and safety standards to ensure that they do not emit harmful pollutants or pose fire hazards. Regulatory agencies can work with international bodies to harmonize these standards and certify products.
- ✓ Energy efficiency standards: Setting clear benchmarks for energy efficiency ensures that cooking technologies deliver the promised reductions in energy use and environmental impact. Efficient appliances not only save money for consumers but also reduce stress on the energy grid.

[11] Integrating Clean Cooking into National Energy Access Planning Tools and Considerations for Planning and Implementing eCooking
[12] Integrating Clean Cooking into National Energy Access Planning Tools and Considerations for Planning and Implementing eCooking

- ✓ Interoperability standards: Standardization of appliances can promote consumer choice and ensure broader compatibility with infrastructure. Interoperability of metering technologies is also important, both in terms of compatibility with different types/models of appliances, as well as with different measurement systems, including utility billing systems or dMRV for carbon finance.

Through standardization, governments can create an environment where businesses are incentivized to innovate and compete based on quality, performance and sustainability, driving the clean cooking market forward.

4. Project scope

The scope of the second IEC Global Impact Fund project, *A path to health, sustainability and development: Accelerating access to clean cooking through conformance to international standards*, is to support an SME-led project in Asia, with the specific country or countries of implementation selected through consultation with stakeholders and based on the quality of responses received.

Projects will be evaluated based on the potential impact that they bring to society, both during and following the current scope. This will be linked to the scalability potential and the sustainability of the activity after the funding has ended. The relevance of international standards and conformity assessment must be embedded in the design of the project. An implementation plan will be co-developed in advance of the implementation of the project to link the programme activities to the desired objectives and impact.

There are many challenges, including that there is no international standard for performance quality for an electric cooking appliance, whether to assess minimum viable performance of the appliance, or comparative performance, where the appliance is assessed relative to others of the same type.[13] Additionally, knowledge of how to test eCooking devices by local testing centres is relatively absent.

Another key challenge relating to standardization is the interoperability of metering solutions. Digitalization of appliances can enable disaggregation of cooking loads from broader household consumption, enabling dedicated pricing of electricity for cooking to incentivize the increased use of cooking appliances. Standardization is needed to ensure integrity in the measurements made by appliance-level meters and interoperability with utility billing systems. AI-powered load disaggregation also offers another pathway, that would also require standardization to enable mass-market adoption.

Another challenge is that most of the existing standards that are relevant for eCooking are for household devices. There is increasing interest in eCooking for institutional and commercial settings, meaning that there will be a need to adapt existing standards to larger appliances and different use cases.

5. Projects activities

The SME(s) granted with funding from the project can implement the project in the area of eCooking as defined by this document taking into consideration the context, background and scope as outlined above. Potential specific areas might include some of the following:

- Identification and analyses of the distinct roles played by stakeholders involved from the importation of appliances to their eventual end-of-life disposal, including piloting of circular models for key eCooking system components and the opportunity to re-use batteries from other sectors (in particular eMobility) to support cooking appliances
- Comparison of different technologies

[13] Modern Energy Cooking Services programme, Briefing Note Series: Towards A Thriving eCook Market in Tanzania, 2022

- Informing on how eCooking considerations can be further integrated into energy access planning approaches[14]
- Enhancement of market knowledge through improved data generation and collection, including gathering of properly collected data on the performance, interoperability and use cases of eCooking appliances in commercial and institutional settings
- Development of novel electricity pricing for eCooking relying on digitalization, potentially via leveraging of emerging carbon methodologies

6. Project objectives (examples)

The successful implementation of the project could contribute to several objectives including the following:

- Further align electrification with energy and clean cooking sectors
- Further align the clean cooking sector with conformance to international standards
- Demonstrate that, through this alignment, impact at scale is more reachable
- Build on and show complementarities with the IEC Global Impact Fund Project 1 *Catalyzing innovation for circular models – Turning battery e-waste into e-resources*
- Enable greater interoperability and ensure that different clean cooking technologies and systems can work together seamlessly
- Ensure that new technologies are compatible with existing quality infrastructure and conform with international standards

7. Project impact

As the world seeks to achieve the UN Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being), SDG 5 (Gender Equality), SDG 7 (Affordable and Clean Energy), and SDG 13 (Climate Action), clean cooking solutions will be essential in ensuring that no one is left behind in the pursuit of a healthier, more sustainable future.

Potential impacts from this project are broad and stretch across these and other SDGs.

8. Project outcomes (examples)

The successful implementation of the project could produce a range of outcomes including the following:

- New business models or revenue streams developed in the eCooking sector
- Greater ownership of eCooking appliances within households/establishments, proper usage of such appliances and long-term and extensive use of appliances for significant proportions of cooking
- Greater use of eCooking in the country/region
- National incentive programmes established to increase eCooking in the region
- Energy access planning projects/targets explicitly leveraging international standards & CA to implement mass eCooking
- Data-based evidence on the positive impact of eCooking at scale

9. Role and responsibilities

The Implementing Partner(s) own(s) the responsibility for implementing the project. Monitoring and evaluation are the responsibility of the IEC Global Impact Fund. An implementation plan will be co-developed by both parties in consultation with National Committees/Affiliates and other stakeholders.

[14] The Integrated Clean Cooking Plan Tool (ICCPT) in Rwanda possibly constitutes the most significant methodological advance to date as it achieves a full methodological integration of clean cooking and electrification for energy access planning and captures the impact of the demand for eCooking on the electricity system through feedback loops. Other open-source tools, such as the Open Source Energy Modelling System (OSeMOSYS), the Open Source Spatial Electrification Tool (OnSSET) and the Open Source Spatial Clean Cooking Tool (OnStove), may also be relevant.

10. Budget

The IEC shall commit an amount of up to CHF 350 000 over a period of two years[15]. In addition to ongoing involvement in the project, reviews will take place at six-monthly intervals to monitor expenditure with agreed milestones, deliverables and link to further disbursements. Additional funding shall be sought from other sources and evaluation will include applicant contributions to the Project (monetary and non-monetary).

11. Relevance of international standards and conformity assessment systems

Product standards are crucial for ensuring the safety, performance and environmental sustainability of electric appliances. These standards, developed through collaboration between diverse stakeholders, set out requirements and test methods to verify various aspects like consumer safety, fair trade and resource efficiency. The use of electric appliances can expose individuals to various hazards, including electrical, mechanical, thermal, fire and radiation risks. To mitigate these risks, safety standards are crucial in verifying that electric cooking appliances provide an acceptable level of protection. These standards typically outline requirements for mechanical design (protection against fire and moving parts), electrical design (protection against electric shock), environmental design (protection against water ingress and corrosion) and clear marking and user instructions. In addition to safety, performance standards are essential for evaluating the energy efficiency and cooking performance of electric cooking appliances. These standards define key performance characteristics and specify methods for measuring them, although they do not set mandatory performance requirements.[16] Conformity assessment needs to be in place to avoid market dumping in countries and ensure interoperability.

- IEC TC 59: Performance of household and similar electrical appliances
- IEC TC 61: Safety of household and similar electrical appliances
- ISO TC 285: Clean cookstoves and clean cooking solutions

- The IEC develops and publishes standards for heating and cooking appliances:
  - Household and similar electrical appliances – Safety – Part 2-6: Particular requirements for stationary cooking ranges, hobs, ovens and similar appliances
  - Household and similar electrical appliances – Safety – Part 2-9: Particular requirements for grills, toasters and similar portable cooking appliances
    ISO 19869:2019 Clean cookstoves and clean cooking solutions – Field testing methods for cookstoves

- The IEC supports UN SDG 7, which aims to ensure access to affordable, reliable, sustainable and modern energy for all by 2030. The IEC contributes to this goal by providing standards and conformity assessment services for clean energy technologies, including clean cooking.etech.iec.ch/issue/2022-04/affordable-sustainable-electricity-for-all
  - The IEC has several PV solar system standards which may contribute to the equipment useful for powering appliances
- For low capacity operations, which might be useful for places with energy access issues: LVDC 633018 www.iec.ch/energies/lvdc

- For efficiency of decentralized electrical energy systems: roadmap Technical Recommendation webstore.iec.ch/publication/65975

- International standards for electricity meters: iec.ch/blog/international-standards-electricity-meters

[15] All funding after 2025 will be subject to the IEC Global Impact Fund continuing after its initial three-year pilot phase
[16] Electric Appliance Quality Ecosystem – A scoping report for the Kenyan Market, August 2024

- Conformity assessment:
  - For safe household appliance utilisation (including cooking appliances): IECEE www.iecee.org/certification/iec-standards/iec-60335-2-92019-61318
  - For safety/shock/explosion: IECEx

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