ETHANOL STOVE INNOVATION HACKATHON: ADVANCING CLEAN COOKING SOLUTIONS

Introduction

Clean cooking involves using technologies that minimise indoor air pollution, enhance energy efficiency, and reduce environmental degradation. In many developing countries, traditional cooking methods heavily rely on biomass fuels such as wood, charcoal, and crop residues. These fuels contribute to deforestation, greenhouse gas emissions, and severe health risks, particularly for women and children, who are most affected by household air pollution.

Despite sustained advocacy for clean cooking in Ghana, many households rely on polluting fuels. According to the 2021 Population and Housing Census, about 54% of households still use charcoal, firewood and other crop residues as their primary cooking fuel. The situation is even worrying in rural areas, where about 78% of households depend on these traditional fuels. Liquefied Petroleum Gas (LPG) remains the leading clean cooking fuel in the country. However, to accelerate Ghana's progress towards universal access to clean cooking, there is a pressing need for alternative technologies to complement LPG efforts. These alternative stoves and fuels must be accessible and affordable to ensure wider adoption.

Ethanol-based stoves and fuels have emerged as a promising alternative for clean cooking. Ethanol can be derived from various organic sources, including agricultural feedstocks, industrial by-products, and municipal waste. A transition to ethanol-based stoves can reduce dependence on wood fuel, improve indoor air quality, and generate economic opportunities in local production and distribution.

The Africa Centre for Energy Policy (ACEP) has long advocated for clean cooking solutions as part of its commitment to sustainable energy and environmental protection. ACEP recently conducted a pilot study to assess consumer attitudes towards ethanol-based cookstoves. The study revealed positive consumer perceptions of ethanol stoves but highlighted critical barriers — including design inefficiencies, limited fuel availability, and affordability concerns. These findings underscore the urgent need for innovation in ethanol stove design that integrates improved fuel efficiency, user safety, affordability, and adaptability to local conditions.

The Hackathon

The Ethanol Stove Innovation Hackathon is designed to encourage youth-led innovations in developing working prototypes of ethanol-based cookstoves that are not only environmentally sustainable but also meet the diverse needs of households in Ghana and beyond. Participants will compete individually or in teams to design stoves that meet a set of minimum performance criteria:

1. **Efficiency**: Optimising ethanol fuel consumption while ensuring effective heat output.
2. **Affordability**: Designed for low-income households without compromising on performance.
3. **Safety**: Incorporating robust safety features for ethanol utilisation.
4. **Local adaptability**: Using locally available materials suited to prevailing cooking practices and production capabilities.

While these represent the baseline requirements, entries will be judged on a broader set of metrics, including design innovation, user experience, aesthetics, feasibility for mass production, durability, business viability, and environmental impact. Submissions that demonstrate the greatest potential for real-world application and scalability will be recognised and rewarded.

A key outcome of the hackathon is to develop a guiding model for ethanol stove development. This model will highlight design principles, material choices, safety standards, and cost considerations that can inform manufacturers, policymakers, and clean energy practitioners seeking to scale up ethanol-based cooking solutions. Ultimately, the hackathon aims to drive innovation in clean cooking, promote youth-led enterprise in the energy sector, and contribute to Ghana's broader goal of universal access to sustainable cooking technologies.

Competition Phases and Process

The Ethanol Stove Innovation Hackathon will be structured as a two-phase process to identify and support innovative stove concepts that combine environmental sustainability with technical and economic viability.

Phase One: Expression of Interest and Conceptual Design

The first phase is the open call for applications, inviting interested applicants to submit preliminary concepts. At this stage, applicants will be required to undertake the following:

1. Present an initial sketch or schematic (not necessarily drawn to scale) of their proposed ethanol stove design. These sketches must convey the proposed stove's basic structure,

layout, and intended functionalities. Submissions with vague or poorly defined sketches will not be considered.

2. A design concept not exceeding 1,500 words. This document should describe the key features of the stove, addressing aspects such as effectiveness, fuel efficiency, safety, ease of use and adaptability to local conditions.

3. A brief profile outlining individual or team competencies, relevant skills, and motivation for participating in the competition.

Assessment at this stage will focus on the originality and clarity of the design concept, alignment with the minimum performance criteria, and the applicant's capacity to develop the idea further. The most promising entries will be shortlisted for advancement to the second phase.

Phase two: Detailed design and feasibility assessment

Shortlisted applicants must refine their design concepts into more detailed technical proposals. This phase is designed to assess the feasibility and readiness of each design for further development into a full prototype. The deliverables for this phase will include:

1. **Detailed Design Documentation (Max 2500 words)**: Applicants must submit a more refined and technically complete stove designs. These should represent all key components and characteristics of the stove, including fuel chambers, combustion systems, safety mechanisms, and heat flow pathways. The design should also be detailed enough to identify materials, fabrication processes, and assembly requirements.

2. **Cost Breakdown and Feasibility**: This aspect must reflect the anticipated material and service costs and an estimated unit cost for producing the stove. This breakdown is essential to evaluate the economic viability of each design. Participants must consider potential challenges (if any) in the production process and propose feasible solutions.

Assessment for this stage will be based on the design's technical soundness, feasibility for mass production, cost efficiency, and alignment with the clean cooking goals of the competition.

Phase three: Prototype Development and Design Guide Finalisation

The successful applicant(s) selected from the previous stage will share in a total grant funding pool of up to **$15,000.00**, intended to cover the costs of materials, fabrication, and testing required to develop a functional ethanol-based stove prototype and a detailed design guide.

This final phase aims to translate the winning concept into a tangible and replicable product that demonstrates practical operability under real-world conditions and reflects the technical and economic strengths presented earlier. To support this process, the selected applicant(s) will

benefit from mentorship and coaching, including guidance from industry experts, user-centered design feedback, and periodic check-ins with the organising team. This is to ensure the resulting prototype meets safety, efficiency, and affordability benchmarks.

The prototype must be constructed using materials and production methods consistent with the original proposal, ensuring it remains cost-effective and scalable. The accompanying design guide should serve as a blueprint for future iterations, adaptation, and potential scaling by third parties. It will be made publicly available to support innovation and wider adoption within the clean cooking ecosystem.

Applicants will retain ownership of their intellectual property, but must agree to license the design guide under an open, non-commercial public license. This ensures that while innovation is protected, the core design can be freely accessed and improved upon by others working to expand clean cooking access.

Eligibility Criteria

The Ethanol Stove Innovation Hackathon is open to young Ghanaian innovators passionate about clean energy, product design, and sustainable development. To ensure the competition meets its goal of nurturing emerging talent, the following criteria will apply:

Nationality: Applicants must be Ghanaian citizens.

Age Limit: Applicants must be 35 years or younger at the time of submission of the Expression of Interest.

Target Participants

- **Tertiary-level students,** including those enrolled in universities, technical universities, and TVET institutions.
- **Early-career professionals** in energy, product design, technical innovation, or related sectors.
- **Young entrepreneurs and innovators** with demonstrable interest or experience in product development, clean energy technologies, or sustainable solutions.

Team or Individual Entry: Applicants may apply as individuals or in teams. For team submissions, the **maximum number of members is five (5)**. All team members must meet the eligibility criteria outlined above.

Skills and Experience: While applicants from diverse academic and professional backgrounds are welcome, those with relevant skills in stove design, mechanical engineering, materials science, environmental health, or industrial design will have an added advantage.

1. **Gender Inclusion**: Female applicants are strongly encouraged to apply, and gender-diverse teams are highly welcomed as part of the competition's commitment to inclusive innovation

Judging Panel

Applications and designs across all phases of the competition will be assessed by an independent panel of expert judges drawn from key institutions and stakeholder groups in the clean energy ecosystem.

Judges will be selected from the following institutions:

1. Academic and research institutions specialised in mechanical engineering, renewable energy systems, and product design.
2. Public sector regulatory bodies and standards agencies responsible for enforcing safety and performance standards for energy technologies.
3. National Fire Service to ensure that safety standards for the safe usage and storage of ethanol are incorporated into stove designs.
4. Civil society organisations and policy think tanks with a track record in advocating for sustainable energy solutions and consumer-centred innovation.
5. Private sector experts and clean energy entrepreneurs engaged in the design, manufacture, or distribution of clean cooking solutions.
6. Development and international agencies supporting innovation and energy access programmes in Ghana.

How to Apply

Interested applicants must complete the Expression of Interest (EOI) form and submit it online. The application form will require applicants to provide the concept sketch, applicant information, design overview and team details. The application process is structured to allow flexibility, as submissions will be accepted on a rolling basis. However, all applicants must ensure that their EOI is submitted no later than **27th July, 2025**.

To submit your application, visit https://acep.africa/ethanol-stove-innovation-hackathon-advancing-clean-cooking-solutions-2/. The portal will guide you through the application process and allow you to upload all required documents. For any questions or further clarifications, please contact the Hackathon Coordination Team at hackathon@acep.africa using the subject "Ethanol Stove Innovation Hackathon".

Bring your energy. Design the future.

Let your innovation fire up change.