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Clean Cooking: Insights from two new AFD and FID Experiments

As global awareness of the need for efficient clean cooking methods continues to grow, a lack of sufficient evidence hinders informed decision-making. This paper summarizes insights from two recent impact evaluations from Burkina Faso and the Democratic Republic of the Congo and identifies effective levers for promoting the adoption and sustained use of clean cooking solutions.

Context: More research is needed for informed decision-making

Cooking methods are at the intersection of multiple challenges

Globally, the use of traditional stoves for cooking remains widespread. Some 2.6 billion people, mainly in Sub-Saharan Africa and South Asia, cook every day on open fires or using basic stoves burning biomass (such as wood, charcoal and agricultural residues). This dependence has serious environmental, health and social consequences. Emissions from wood combustion and the deforestation caused by the use of traditional stoves are responsible for almost 2.5% of global greenhouse gas (GHG) emissions. The resulting air pollution reaches extremely high levels, causing more than three million premature deaths every year. In cooking spaces, women and children are the ones mainly exposed to concentrations of fine particles well above the threshold recommended by the World Health Organization (WHO).[1]

Universal access to efficient clean cooking (ECC) is not only a health and gender issue but also a key factor in combating climate change and preserving natural resources. Theoretically, adopting clean cooking solutions could help reduce greenhouse gas emissions and deforestation while improving air quality, thereby lowering health risks. For households, ECC can enhance productivity and empower women by reducing the time spent collecting firewood and cooking.

A growing global awareness of the urgent need to act

In May 2024, an international Summit on Clean Cooking in Africa was held in Paris. Leaders from several African countries pledged to dedicate $2.2 billion of investment to the ECC sector. **France, for its part, announced €100 million of support over a five-year period, implemented by the AFD Group, as well as the mobilization of the Finance in Common networks to accelerate the transition.**

To ensure these substantial investments are truly cost-effective and can generate societal impact, it is crucial that they be directed toward operations that not only provide access to efficient new technologies, but also guarantee their sustainable use. However, there is still a lack of research in this area, particularly concerning the financial and socio-cultural barriers to the widespread adoption of ECC methods.

[1] The threshold defined by WHO for an individual exposure over 24h is 5 µg/m³. It can largely exceed 100 µg/m³ in the kitchens of households cooking with wood, especially when they are indoors.

Authors

Rita ABDEL SATER (AFD)
Julia GIRARD (AFD)
Patrice LÉGER (FID)
Léa MACIAS (AFD)

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AFD and FID impact evaluations

In this context, the French Development Agency (AFD) and the Fund for Innovation in Development (FID) financed two experimental impact evaluations, in the form of randomized controlled trials (see infographic).

Box 1. Randomized controlled trial (RCT)

An RCT is an impact evaluation method that compares two randomly selected groups within the eligible population: one receives the program and the other does not and serves as a comparison group. This randomization and the presence of this comparison group ensures that any observed changes can be attributed to the program, while controlling for external factors that could otherwise confound the results.

The first experiment focuses on improving access to LPG kits south of Ouagadougou, Burkina Faso.[2] With 83% of the population in Burkina Faso relying mainly on wood for cooking, and only 13% having access to cleaner cooking solutions such as LPG or electricity, the social enterprise Nafa Naana, supported by AFD, offers low-income households the opportunity to purchase the "Télia Kit". This kit includes a basic gas stove model designed for local cooking practices, a 6kg LPG bottle, a burner, and a locally made pot base, all for CFA 25,000. By providing subsidies or access to credits, the initiative is expected to facilitate the acquisition of a gas stove and enable households to reduce their wood consumption, and thereby their exposure to the harmful air pollution it generates.

The second experiment takes place in Goma, North Kivu, Democratic Republic of the Congo, where 95% of households primarily rely on charcoal for cooking. For a typical household, it represents an average expenditure of $30 a month - 20% of their total budget. With limited plantations, this exponential demand is largely satisfied by illegal charcoal production by armed groups in the Virunga National Park, the oldest national park in Africa and a UNESCO World Heritage Site. The project provides electric pressure cookers, fully subsidized by the hydro-electric energy supplier Virunga Energies, to families connected to the electricity grid who primarily use charcoal for cooking. This high energy-efficiency appliance combines a hotplate with insulation and high pressure. The initiative is expected to lower charcoal demand while increasing electricity use, generating a return on investment for the company.

Valuable lessons learned from these studies, enable us to identify the levers of action available to decision-makers to incentivize the use of clean cooking methods.

Available levers can ensure sustainable adoption and help generate social and environmental impacts

Promoting adoption and sustainable use through financial support and information provision

In 2021, UN ESCAP published a study analyzing several clean cooking initiatives. The evaluations revealed that the anticipated outcomes are not always achieved in practice. One key finding is that while the adoption of clean cooking methods increases, it remains limited, and these technologies are not consistently used over time. This can be attributed to financial and behavioral barriers, including the high cost of technologies and fuel, challenges in usage and maintenance, incompatibility with local needs and practices, and a lack of awareness about their benefits.

The two experimental studies supported by AFD and FID confirm these trends. While they demonstrate a clear demand and interest in acquiring alternative cooking methods, they also demonstrate the need for financial and social support.

This shows that financial support, in the form of credits or subsidies to incentivize the acquisition of clean cooking appliances, is effective in increasing the share of households with access to these technologies. For example, the REDGAS study shows that this type of financial incentive significantly increases access to cooking with gas. However, access does not necessarily lead to sustained use: during the final survey of the REDGAS study, 30% of the gas stove kits acquired by the households had not been used for at least 30 days. Furthermore, the adoption is higher among households that benefited from subsidies, but their use is less intensive,[3] reflecting the constraints of the adoption of LPG. Conversely, adoption is lower when loans are involved, but use is more intensive.

In Goma, covering the total purchase price of equipments lead 85% of households to durably adopt electric cooking. This has enabled households to reduce their charcoal consumption by 35% and reduce their total energy spending, despite the increase in their electricity expenses. The electricity supplier is reimbursed for the free provision of electric pressure cookers through an increase in revenues from electricity sales.

Furthermore, the experiment of Goma hints that providing a free top-up of electricity with the cooker lead to higher usage in the first weeks but not in the longer term. It also shows that an environmental awareness-raising campaign, which also emphasized the implication of charcoal consumption in the dynamic of conflicts in Eastern DRC, lead to a greater usage of the cookers. This highlights that pro-social considerations can be leveraged to accelerate the transition to clean cooking.

Environmental and health benefits are conditional on biomass substitution

While the existing experimental studies on clean cooking programs find a reduction in the consumption of biomass and the time spent collecting it and preparing meals, they observe little sanitary and environmental impacts.

This is primarily due to the fact that most of them focus on improved stoves that still use biomass. In this regard, cooking methods considered "cleaner", such as cookers using liquefied petroleum gas (LPG) or electricity, as implemented in the experiments financed by AFD and FID, or biogas, should have a greater impact. However, their greater technical complexity can make them harder to use, maintain and repair. Combined with the financial and social barriers, this could ultimately results in a lower adoption and/or a less sustained use.

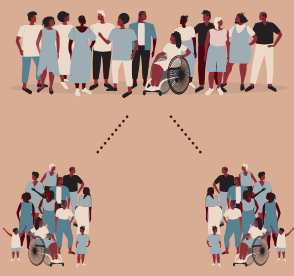
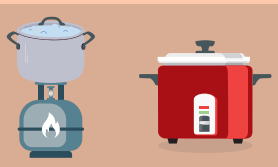
In addition, the adoption of ECC methods may result in a

[2] On the REDGAS randomized study, see Thivillon *et al.*, 2024.

[3] "Use" means the time during which the appliance is used by households. It is an average rate.

What do we know about the effectiveness of interventions to promote clean cooking?

Comparison of the findings of two impact evaluations

	Burkina Faso	Democratic Republic of the Congo
Location		
Technology studied	LPG Kit	Electric pressure cooker
Financing	AFD	FID
Which interventions are tested?	 **805 households** **Group 1: Credit** • Payment in 3 instalments for the purchase of the LPG kit **Group 2: Subsidy** • 38% reduction compared to the market price for the purchase of the LPG kit **Group 3: Control group** • No intervention	**1,594 households** **Group 1:** • Electric pressure cooker **Group 2:** • Electric pressure cooker + Electricity voucher for 20kwh **Group 3:** • Electric pressure cooker + Awareness-raising **Group 4:** • Electric pressure cooker + Electricity voucher + Awareness-raising **Group 5: Control group** • No intervention
What acquisition and adoption by households?	 **A large number of households buy the LPG kit, but more when the kit is subsidized** **49%** of households that received a credit offer have the kit at home, against **75%** of households that received a subsidized kit.	**A widespread adoption of the electric pressure cooker** **91%** of households selected to participate attended the demonstration session and received the electric pressure cooker. **85%** of the beneficiaries state that they regularly use the electric pressure cooker over a period of 12 months.
How often is the equipment used?	 **An intensive use of the LPG kits** **40%** of the kits are used on a given day after 6 months. **20 minutes** of use per household per day. Households mainly use the kit to consume more hot meals.	**A widespread use of the electric pressure cookers** **43%** of meals are prepared using the electric pressure cooker. Awareness-raising further increase usage of the cooker. The electricity voucher has no additional effect.
What are the effect on biomass consumption?	 **For households that collect their wood for free:** **+23%** of total energy consumption, linked to fuel stacking (no substitution effect with wood). **For households that buy their wood (34 %):** **-640g** of wood consumed per day, *i.e.*, a reduction of 11%.	**The adoption of the electric pressure cooker results in biomass being replaced by electricity** **-35% of charcoal consumed,** related to the replacement of a polluting cooking method by a cleaner cooking method.
What social and environmental impacts?	 **The health impacts vary across households** **For households that collect their wood for free:** • No effect on pollution • No health effect **For households that buy their wood (34 %):** **-17%** of fine particles, and thus a positive impact on air quality.	**The impact is positive for both households and the environment (in projections)** **The initial subsidy ($94 over a 5-year period) would allow:** • Households to save $320 • Energy distributors to save $70 • The equivalent of $187.5 of CO_2 emissions to be avoided The usage of 20,000 electric pressure cookers over 5 years would save 800 hectares of forest, the habitat size needed for a group of gorillas.

phenomenon known as "fuel stacking": households continue to use their usual cooking methods at the same time, which limits the potential benefits of clean cooking solutions.

This trend was observed in the REDGAS study. Indeed, the findings do not show a significant decrease in exposure to air pollution, as the wood consumption of households does not fall once they have access to gas. Instead, the financial incentives increases total energy consumption and allows households to consume more hot meals. This could be due to the fact that a large proportion of households collect their wood for free and thus have little incentive to stop using it, especially if the household considers that all its energy needs have not been met. In fact, only the households that buy their wood reduce their consumption (-11%) and thereby their exposure to fine particles by 17%.

In Goma, where biomass is costly, the surveyed households reduce their charcoal consumption, which results in a reduction of CO_2 emissions at a competitive cost ($12/ton). This leads to a reduction in deforestation and to biodiversity protection, in particular a better protection of mountain gorilla's habitat.

Conclusion

These two studies show that an effective improvement in access to clean cooking can have significant effects. But this is dependent on certain prerequisites. As such, the use of the new alternatives needs to be less expensive, and their deployment needs to be combined with awareness-raising activities. This could help avoid fuel stacking, but still requires a level of social and behavioral change that can be difficult to achieve. Decision-makers do have effective levers for accelerating the development of clean cooking, particularly by alleviating financial constraints. However, it is crucial to keep conducting field experiments to refine our understanding of the barriers related to the adoption and sustained use of these new technologies, allowing for adjustments before scale-up.

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