

C. Performance



What does this type of evaluation tell us?

This type of evaluation is concerned with measuring impacts of interventions on combustion efficiency, wood consumption, cooking time and general performance.

It is critical that improved stoves and other devices are tested for efficiency and emissions during the project planning and development phases to ensure that they are safe, and represent an improvement over traditional practices. Further tests may be applied during the evaluation of a project to determine user satisfaction and operational performance.

Laboratory or field-based testing?

Laboratory testing is usually a critical first step in establishing the performance of a new device. Laboratory testing controls variables such as wood type, and can be based on standardized testing methods. This has obvious advantages in terms of comparing stoves with one another as part of the same project or programme as well as between different projects or programmes around the world.

Yet, the use of a given cooking technology in the field presents a range of challenges and variables that are very different from those encountered in a laboratory: efficiency, emissions and specific fuel consumption are highly dependent

on stove installation, maintenance and operation. Therefore, it is also important to test stoves in ways that reflect actual usage as closely as possible, for example in people's homes.

Absolute or comparative values?

Although knowing absolute values for efficiency is of some use, comparative figures tend to be more useful and relevant for assessing the impact of an intervention and from the perspective of beneficiaries. For example, an improved stove could be correctly described as '17% efficient', or more usefully as 'twice as efficient and fast as a traditional stove' (see also Box 2).

What are important performance parameters?

There are no established performance criteria for cooking stoves, but there is relatively broad agreement on which parameters should be measured and which performance tests should be used (see also Box 3).

Efficiency

Efficiency is a measure of how much of the energy in wood is transferred into the pot and is often seen as the most effective way of determining stove performance. Efficiency is a product of combustion efficiency and heat transfer efficiency (i.e. how well the energy released from the wood is transferred to the pot):

$$\text{Efficiency} = \text{combustion efficiency} * \text{heat transfer efficiency}$$

Consequently, high stove efficiency does not necessarily mean a clean stove, as an increase in heat transfer efficiency may be achieved at the expense of combustion efficiency, and vice versa. Efficiency tests also reward the stove for the production of steam which is considered wastage during cooking.

Specific fuel consumption

Specific fuel consumption is defined as fuel used per unit of meal cooked, for example 'kilograms wood per pot of beans cooked'.

BOX 2 A simple evaluation: comparative cooking test¹

A household energy project in India had very few resources but wanted to evaluate improved stoves in a way that was relevant and appropriate to the users. In the village of Chibau Khera the improved *Mina* stove was developed for use by mostly female domestic cooks. These were therefore chosen to be the testers, and the basis of the test was cooking a typical family meal in the village.

Public tests simulated the cooking of a typical family meal sufficient to feed six people. Two women cooked identical meals side by side, one on an improved *Mina* stove, the other on a traditional u-shaped stove. The same type of wood was provided to both women and the amount used weighed.

The purpose of the tests was described to the women. They were asked to use the stoves as they would in their own homes, and to try to use the fuel efficiently by keeping small fires for simmering and keeping burning wood well inside the firebox. No other instruction was given and the women were left to cook without any interference from the fieldworkers.

The tests revealed that the improved *Mina* stove saved 30 minutes (35%) in cooking time and used 0.5 kg (25%) less wood than the traditional u-shaped stove. In addition, the women using the *Mina* stove commented that the stove emitted considerably less smoke and that having two pot holes was more convenient.

Many women, men and children observed the tests which were followed by an announcement of the results and a meal. These public tests did much to raise the profile and popularity of the stove.

BOX 3 What about emissions testing?

Emissions testing can be used as a measure of combustion efficiency and represents a useful way of comparing different stove types or stoves in different settings. Emissions testing is, however, mostly used as a way of determining the impact of an intervention on the environment, notably through the release of greenhouse gases. Therefore, the emissions tests included in this catalogue are listed in Section G *Environmental impacts*.

The evaluation methods recommended in this catalogue are based on specific fuel use for cooking or other specified tasks, and reflect real-life conditions more accurately. Unlike efficiency testing, specific fuel consumption accounts for steam production as wastage.

Turn down ratio

This is also known as control efficiency, determined by noting the difference in fuel consumption per minute between high power (bringing water to a boil or frying) and low power (sim-

mering). Stoves with a higher turn down ratio are likely to use less fuel during a real cooking task, which involves bringing food to a boil and then cooking it at a simmer for an extended period of time.

Key questions

- By what percentage does the intervention reduce specific fuel consumption in the laboratory, and in users' homes? How much fuel is saved on average?
- Is the improved stove or cooking device more or less efficient, convenient, time-consuming and user-friendly for specific cooking needs compared with traditional practices or technologies?
- Do improved stoves or cooking technologies continue to perform after an initial trial period (e.g. 3 months)? After 1 year? After 5 years? What are the reasons for discontinued use or performance (e.g. lack of maintenance)?
- What behavioural factors influence performance (e.g. maintenance of stove, dryness of fuel, use of pot lids, cultural beliefs)?
- How easily can cooks adjust the temperature for specific dishes? How does the turn-down capability of the improved stove or cooking technology rate?

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- How effective have complementary cooking devices, such as retained heat cookers, been?






What are the challenges?

Most methods recommended for testing the performance of cooking devices require some training and basic equipment. The comparative cooking test is an exception, as it does not necessitate specific resources and could be undertaken by any organization.

Available methods

The methods presented in Table 5 primarily focus on improved stoves and other cooking technologies but they can also be used to measure the effectiveness of certain behaviour changes related to cooking stoves (e.g. changes in the way fuel is used) as well as interventions to supplement traditional cooking practices, such as hayboxes.

Table 5 Evaluating performance

ID	Method	Organization	Relevant section of method	Rating
Recommended methods				
C2	VITA stove performance tests	Enterprise Works/VITA	All	
C3	Water boiling test	Household energy and health team, UCB	All	
C4	Kitchen performance test		All	
C5	Controlled cooking test		All	
Additional methods				
C1	Comparative cooking test	—	—	

A – Adoption; B – Market development; C – Performance; D – Pollution levels and personal exposure; E – Health and Safety; F – Time and socio-economic impacts; G – Environmental impacts; Y – Generic methods.