

Catalogue of methods for evaluating household energy interventions

Chapter V – Evaluation method summaries

1. Details

[Name of method, list of components (e.g. questionnaire, data entry form), primary contact name and address, webpage address]

University of California-Berkeley Stove Performance Testing Protocols

These protocols consist of three separate tests:

- Water Boiling test (WBT)
- Controlled Cooking Test (CCT)
- Kitchen Performance Test (KPT)

List of components

All tests consist of a written protocol, a data entry form (software and hard copy), and a data calculation file (MS Excel). In addition, the KPT has two questionnaires which evaluate pre- and post-intervention assessments.

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2. Purpose

WBT – a simple, standardized, and repeatable test to assess efficiency, specific fuel consumption, and time to boil a fixed quantity of water. This is most appropriate for the early stages of stove development when basic design features are being compared and evaluated relative to the traditional or unimproved stove model(s).

CCT – a slightly more complex, but still standardized and repeatable test to evaluate the performance behavior of a newly developed stove and compare it to the traditional stove under realistic cooking conditions. A real end-user should be recruited to obtain an unbiased view of stove performance.

KPT – consists of two questionnaires and a simple field measurement repeated in a number of households. The purpose of the questionnaires is to collect socioeconomic data and household energy information before and after the stove intervention. The purpose of the field measurement is to obtain statistically-robust quantitative data on fuel consumption.

3. Summary

{1-2 paragraphs. What does it do, what doesn't it do, where was it designed for etc?}

Water Boiling Test (WBT)

This modified version of the well-known VITA Water Boiling Test (WBT) is a simulation of the cooking process that can be performed on most stoves in use throughout the world. It is designed to be a simple method by which stoves made in different places and for different cooking applications may be compared by a standardized and replicable protocol. Data obtained from a few days of testing assists stove designers to develop better performing stoves, which can then be tested by cooks in their intended environment.

Rather than report a single number indicating the thermal efficiency of the stove, which alone cannot predict stove performance, this test is designed to yield several numerical indicators including: time to boil, burning rate, specific fuel consumption, firepower, and turn-down ratio (ratio of the stove's high power output to its low power output). Note that a direct calculation of thermal efficiency derived from the Water Boiling Test is not a good indicator of the stove's performance, because it rewards the excess production of steam.

Controlled Cooking Test (CCT)

The CCT is designed to assess the performance of an improved stove relative to the common or traditional stoves that the improved model is meant to replace. Stoves are compared as they perform a standard cooking task that is closer to the actual cooking that local people do every day. However, the tests are designed in a way that minimizes the influence of other factors and allows for the test conditions to be reproduced.

Kitchen Performance Test (KPT)

The KPT includes both quantitative surveys of fuel consumption and qualitative surveys of stove performance and acceptability. The field test includes two qualitative surveys: the first helps project designers to assess household cooking practices prior to the introduction of an improved stove and the other provides them with follow-up data 3-6 months after the stove has been introduced to the family. There are two main goals of the KPT: (1) to compare the performance of improved stove(s) to the traditional (common) stoves or to other improved stoves as they are used in the kitchens of real families and (2) to identify qualitative aspects of stove performance through a simple survey. This test is the best way to understand a stove's impact on actual fuel use and on more general household characteristics and behaviors, because it occurs in the homes of stove users. Such claims cannot be based on lab-based tests alone.

4. Resources

[Training, equipment and financial requirements for using this method]

Equipment for one Water Boiling Test:

- Scale of at least 6 kg capacity and 1 gram accuracy
- Digital thermometer, accurate to 1/10 of a degree, with thermocouple probe suitable for immersion in liquids
- Wood moisture meter (optional)
- Timer
- Standard pot(s) (use other pots if the standard pot does not fit the stove)
- Wood fixture for holding thermocouple probe in water
- At least 15 liters of clean water for each WBT
- Heat resistant pad to protect scale
- Small shovel/spatula to remove charcoal from stove
- Tongs for handling charcoal
- Dust pan for transferring charcoal
- Metal tray to hold charcoal for weighing
- Heat resistant gloves
- 3 bundles of air-dried fuelwood each weighing between 1 and 2 kg

Equipment for the Controlled Cooking Test:

The equipment required to conduct a series of CCTs is similar to the equipment required to perform the WBT. In addition, a sufficient quantity of food is needed to conduct all of the tests.

Equipment for the quantitative fuel consumption Kitchen Performance Test:

- Pots and other cooking utensils (supplied by each household; they need not be standardized)
- Fuel (depending on the local situation, testers may want to provide fuel to the households)
- Wood moisture meter (or other method to determine fuel moisture)

5. Other useful information

[E.g. operational/ analytical issues]

There are advantages and disadvantages to each of the three tests described in these protocols. The lab-based WBT and CCT tests are more appropriate at the early stages of stove development, because they can provide insight into various technical aspects of stove design. These two lab-based tests are also more appropriate when comparing stoves that are used in different regions of the world. There is a great amount of variation in cooking practices, fuels, and household environments throughout the world's developing regions that makes direct comparisons of actual stoves in people's kitchen very difficult. Lab-based tests eliminate the variability in factors that may affect stove performance other than the physical characteristics of the stove itself.

While lab-based tests allow stove developers to differentiate between well-designed and poorly-designed stoves, they give little indication of how the stoves are actually used by the people who are targeted by stove projects. In order to know if stove projects are having the desired impact, the stoves must be measured under real conditions of use.

6. Copyright and referencing

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All materials are in the public domain. Provided the materials are referenced, they may be freely distributed and used.

Users should refer to the Center for Entrepreneurship in International Health and Development (CEIHD) website (http://ceihd.berkeley.edu/heh.stove_perf_eval.htm) for protocol updates.

Reference

Shell Foundation Household Energy and Health Team, **University of California-Berkeley Stove Performance Testing Protocols** (October 2005), University of California, Berkeley, 2004-5, http://ceihd.berkeley.edu/heh.stove_perf_eval.htm