



COLUMBIA UNIVERSITY
THE EARTH INSTITUTE

MVP Household Stove Testing Protocol Controlled Cooking Test (CCT)



Table of Contents

Overview.....	2
CCT Testing.....	2
Preparing for the CCT Testing	3
Materials Needed for CCT Testing.....	4
CCT Testing Procedure.....	4
General Guidelines and Notes.....	5
Appendix 1: Preliminary Cooking Survey.....	7

Overview

Roughly half of the world's population burns solid biomass fuels for cooking and heating needs. Throughout poor, rural areas of sub-Saharan Africa, biomass is the dominant fuel, and cooking is usually performed using a simple three-stone fire (or "open fire"), in poorly ventilated structures. The inefficient and incomplete combustion of these fuels without good ventilation produces high indoor concentrations of health damaging pollutants including particulate matter and carbon monoxide. Indoor air pollution (IAP) exposure levels in households far exceed international standards and guidelines. IAP exposure from combustion of solid fuel is associated with acute lower respiratory infections, chronic obstructive pulmonary disease, and lung cancer.



CCT Testing in Potou, Senegal

The motivation behind introducing biomass cookstoves to the Millennium Villages is to identify appropriate technologies that not only provide a highly efficient combustion (thereby reducing the stress on the environment) but also to do it in a manner that does not deviate a lot from traditional cooking preferences.

In order to pre-screen solutions that would meet the technical specification standards, Columbia University labs tested various available cookstoves in the market to identify the top few in each category. These cookstoves were initially tested for their heat transferring abilities, general quality of manufacturing as well as for overall efficiency. In order to establish the performance of these improved stoves in the context of the Millennium Villages, the stoves also undergo Controlled Cooking Tests (CCTs) in the Millennium Village (MVs), testing the stoves for efficiency in the local context. The MVP protocol for conducting CCTs in the MVs follows.

CCT Testing

The controlled cooking test (CCT) is designed to assess the performance of the 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 actually done by local people 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.

Example: Ikaram, Nigeria Testing

Each household cooked rice, yams or beans for the test. Three different types of stoves were tested simultaneously: the 3-stone fire, the Envirofit, and the StoveTec stove. The same quantity (in kg) of food was prepared on each stove and in the same manner. The teams visited each household twice.

Preparing for the CCT Testing

The first step in preparing for CCT testing is to identify village participants that will test factory-made stoves that may be introduced to the village if they can be proven to save firewood. Participants should be identified using of the preliminary surveys to identify households. Preliminary survey is included in Appendix I.

If the answers in Part 1 above are clear and acceptable (households should have one primary cook who uses a three stone fire for the dish cooked most often AND the dish requiring the most fuelwood), then the test should be described to the participants and they should be asked for their agreement. MVP recommends the following language when asking for permission:

õWe will leave 3 new, factory-made stoves with you for cooking practice. Please practice using them to cook two foods:

- *the one you eat most often, and*
- *the one that requires the most fuelwood.*

Do your best to follow instructions for the stoves that we will provide you (use of pot skirts, care with stoves, etc.)õ

The trainers should be familiar with the StoveTec and Envirofit manuals as provided to the users in the stove boxes. They should train participants on the proper use of the improved stoves, including:

- The stoves should be handled carefully. The stoves themselves are rugged, but the insulating bricks inside the combustion chambers can be damaged by rough treatment.
- Emphasize that cooks should use both the pot skirt and the metal fuel shelf, or other features of the stoves. NOTE: Many of the households will very likely reject the pot skirt and refuse to use it during practice. This is part of the experiment. During testing, MVP allows cooks to perform the test using the stoves as they prefer. They should not be forced to cook õcorrectlyõ ó one of the objectives of the test is trying to discover how the stoves perform under non-ideal use practices.
- The manner in which fuelwood is prepared is largely uncontrollable. Households will likely use wood of whatever dryness/wetness, size and type is easily available. This is also part of the test, to see how stoves perform under non-ideal fuelwood use.

Allow the cooks to take the stoves home for two weeks and cook with them. After these two weeks of allowing the cooks to use the improved stoves, they are sufficiently prepared to begin CCTs.

Materials Needed for CCT Testing

- **Fuel:** Sufficient wood for all testing should be obtained ahead of time. The wood should be split and dried and stored indoors. The wood should be uniformly mixed such that the wood used for each stove is approximately the same. Allow for some margin of error by collecting more wood than is expected to be used.
- **Food and water:** Testers should be sure they have sufficient food and water for the entire range of tests.
- **Cooking saucepans:** The testers will provide the cooks with three 32 cm diameter pots.
- **Scales:** Used to measure the weight of wood, remaining charcoal, and weight of dry ingredients.
- **Watch or timer:** The testers will be required to time each test accurately and record testing time.
- **Calculators**
- **3 buckets for measuring volumes of water**
- **Rope or banana fibers:** for bundling wood



Materials for CCTs in Potou, Senegal

CCT Testing Procedure

The following testing procedure must be completed exactly each time a CCT is conducted.

1. Explain to the cooks what the purpose of the test is and explain the importance of them following as close to their normal procedures as possible on each stove. Make sure they understand that all of the fuelwood, food, and water must be measured before testing and that any wood added to each fire must be taken from each stove's assigned pile.
2. Weigh out bundles of wood for each stove and set them next to the designated stove. Weigh all dry ingredients. Weigh the pots the food will be cooked in. The quantity of food normally cooked for the household should be prepared on each stove. That is, if testing two stoves at once, each stove should cook the quantity for the entire household, resulting in the total quantity being double the normal. Each stove should cook the exact same quantity of food.

Be sure to record all of this on the data sheet. Additionally, the water added to each stove must be the same within tests and proportional across tests.

3. Allow the cook(s) to light the fire in a way that reflects local practices. Record the time.
4. While the cook performs the cooking tasks, describe the cooking procedure in as much detail as possible so that both stove users and testers can understand and follow. Make sure the cook prepares the food in as close to the same manner on each stove, such that there is no variation in preparation from stove to stove.
5. When each dish is finished, record the time. Weigh the food in the pot and subtract the weight of the empty pot to calculate the weight of food cooked.
6. Remove the unburned wood from the fire and knock the charcoal from the ends of the unburned wood. Weigh the unburned wood from the stove with the remaining wood from the original bundle. Any charcoal that will be reused needs to be weighed as a separate quantity and recorded on the data sheet.
7. Before finishing, make sure that all required data is recorded on the data sheet. Without every piece of information, the analysis cannot be completed.

General Guidelines and Notes

- A few days before the actual test confirm the date with the primary cook, including all provisions for necessary firewood, water and food. Not confirming these dates ahead of time may result in late start times, unavailability of cooks and materials, or lost days. Households may also need to start some food preparation ó such as soaking beans ó the day before.
- Doing all of the preparations in the kitchen (setting out and weighing fuelwood, food, etc.) takes a lot of time, and a rural kitchen can be noisy and strange and chaotic. It is prudent for the tester to practice ahead of time with his / her enumerator team.
- Be especially alert to cooks trying to take food from the wrong pile. This is one of the most common mistakes.
- Any other foods prepared for the meal should be prepared on a separate stove not included in the test.
- Testers and **enumerators role is to observe** and take measurements according to the cook's normal practice. **The enumerators should NOT assist with building or tending the fires.** This should be left to the cooks so that the stove is operated in the way that it is normally done. The goal of the testing is to make measurements with minimal interference with normal stove operation.

- Check up with the enumerators frequently during the testing. Make sure that the enumerators are starting on time, recording data correctly and allowing the cooks to follow traditional cooking methods.
- Make notes about the steps taken in preparation of the food, noting times water or other ingredients are removed or added, steps taken in the preparation, etc.
- Only charcoal that will be re-used should be weighed after the cooking is finished. It should be weighed separately from the remaining unburned wood. **The charcoals should NOT be put out with water before weighing;** this adds weight and introduces error to the measurement. Most households in the region do not reuse charcoal, so most likely the charcoal will not need to be weighed.
- Data should be cleaned frequently ó faulty testing methodology should be flagged and explained and any interrupted tests (by rain, etc.) should be discarded.

Appendix 1: Preliminary Cooking Survey

1. Interviewer:	2. Date of Interview:	3. Interview Start Time	4. Interview Stop Time

5. Name: Head of Household	6. Number from Data Manager's (Sia's) List	7. Respondent Name (Must be PRIMARY household cook)	8. Village:	9. Sub-village:

10. How many people do you cook for in a TYPICAL meal?	11. Do others help? If Y describe:	12. Is the 3 stone fire your PRIMARY stove (used for MOST cooking)?	13. Do you own any other type of stove? If so, describe:
Total:	Y / N	Y / N	Y / N
	Notes:	Notes:	Notes:

14. What ONE food do you cook MOST OFTEN? (choose ONE)		
15. How many days per week do you USUALLY cook this?		_____ days / week
16. Do you USUALLY use the 3-stone fire to cook this? (if N, what other stove do you USUALLY use?)		Y / N
		Notes:
17. How long (hours) does it take to cook this? (can be decimal: 0.5)		_____ hours
18. How much of this do you USUALLY make per meal (kg, DRY)		_____ kg
19. Please show us the pot you USUALLY use to cook this:	19.a. Diameter at top: _____ cm	19.c. Pot material: (circle one) CLAY / METAL
	19.b. Depth at center: _____ cm	19.d. Is the pot bottom: (circle one) ROUNDED / FLAT
20. Describe preparations USUALLY done for this food (note those that begin hours or days before, e.g. soaking).		

21. What food uses the MOST firewood to cook one batch? (choose ONE)	
22. How many days per week do you USUALLY cook this?	_____ days / week

23. Do you USUALLY use the 3-stone fire to cook this? (if N, what other stove do you USUALLY use?)		Y / N
		Notes:
24. How long (hours) does it take to cook this? (can be decimal: 1.75)		_____ hours
25. How much of this do you USUALLY make per meal (kg, DRY)		_____ kg
26. Please show us the pot you USUALLY use to cook this:	19.a. Diameter at top: _____ cm	19.c. Pot material: (circle one) CLAY / METAL
	19.b. Depth at center: _____ cm	19.d. Is the pot bottom: (circle one) ROUNDED / FLAT
27. Describe preparations USUALLY done for this food (note those that begin hours or days before, e.g. soaking).		
28. What type of fuelwood do you usually use to cook?		