

Summarized Controlled Cooking Test (CCT)

The controlled cooking test (CCT) analyzes how the new stove performs compared to common or traditional cooking methods. Stoves are compared as local cooks prepare a traditional food.

By cooking the same food in the same pot, different stoves can show how they perform. Local cooks prepare their favorite food and see whether the new stove is to their liking. For this reason, the CCT should be done when contemplating the introduction of a new stove.

We will use the test to do the following:

- Compare the amount of fuel used by different stoves to cook a favorite food or meal.
- Compare the time needed to cook that food.
- Inquire whether the cooks like how the stove cooks their favorite food.
- Investigate the emissions made during the test of the old and new stove.

Because different pots and fuel are used in different places the results of the CCT are used to compare stoves from one place. Tests from different places can be compared only if the pot, wood and operation of the stove are the same, which is unusual. *The most important metric from the CCT is the “% Improvement” when switching stoves.*

The cooks should be experienced in running each stove. It is recommended that the cook use the stove for at least two weeks before the testing. It is best that the tests be done with each cook in an isolated place in as casual and normal an environment as possible. The tester should not talk to the cook once the test has started and certainly not suggest to the cook how to use the stove, etc. In many situations, women feel more comfortable around other women. If this is the case, it is preferable to have women record the testing.

Each stove/cook combination will be tested three times. It is best for a local cook to test the traditional method three times and the new stove three times. A complete test series (3 improved and 3 traditional) with three separate cooks should be considered the minimum number. Then, based on the difference between the traditional and improved stoves found from the results of the testing series of the first three cooks, the number of additional test series will be decided. More cooks should be used until a statistical t-test shows a 95% confidence. Statistically speaking, less difference between the stoves will require more cooks to prove that difference.

The CCT only requires cooking one type of food. However, stove testers are encouraged to develop a CCT for preparing a combination of foods, if more extensive testing seems important.

CCT with Emissions

Measuring the emissions made during the CCT can be done in two ways.

1.) The tests are performed under a hood type system that captures a representative sample (the ARACHNE) or all the emissions (the PEMS). The ARACHNE or PEMS can be set up in any controlled environment in which wind does not disturb the test. Cooks can come to the hood or the hood can be moved to the cook's home.

2.) Emissions are measured in room air using various monitors such as pump and filter systems, the UCB or Aprovecho IAP Meter, etc. All the testing can occur in a Test Kitchen or each cook can complete her test series in her own kitchen. The confounding variables are controlled as much as

possible by having all the tests done in one kitchen. However, since the short CCT measures the same cook using both the traditional and improved stove, the differences in IAP levels between the stoves can be seen in her own kitchen as well.

Supplies Needed

- A normal mix of fuelwood, enough to test all the stoves, should be found and allowed to air dry. Cooks help the testers to gather the usual dry firewood. Make sure that enough wood is gathered to do all tests. Make sure that all the wood is uniform in size and moisture content. The fuel may be divided into pre-weighed bundles to save time during testing. Testers can take pre-weighed bundles to the testing site, then return with the remaining fuel to the scale. Or each tester can take a scale with them.
- Gather enough food and water for all the tests that will be done. Like the fuel, the food should be completely normal (For instance, assida is suggested for Darfur). Food can be pre-weighed if convenient or a scale can accompany the tester to the testing site.
- Cooking pot: the same type (size, shape, and material) of pot should be used to test each stove.
- Lids should be used if they are commonly used by local cooks.
- Digital scale 10 kg capacity and 1-2 gram accuracy.
- Heat resistant pad to protect scale when weighing hot charcoal.
- Timer.
- Small shovel/spatula to remove charcoal from stove for weighing.
- Metal tray to hold charcoal for weighing.
- Heat resistant gloves.

CCT Procedure

As in any test, the cook controls how much wood is used. The cook should try to perform each test in the same way. If the results are very different the average will not be statistically significant and more tests will be required. We recommend starting with three tests for each stove that is being compared.

1. The first step in the CCT is to have local people choose the food to be cooked. This should be done well ahead of time, to ensure that sufficient food can be obtained for all of the tests.
 - If the stove is designed for cooking all types of food, then a typical amount of food should be decided upon. More than one dish can be prepared, but it is best to keep the testing simple. The box above shows an example of the food used for a CCT in West Africa (from Baldwin, 1987).
 - If the stove is designed for specific foods, for example making tortillas or chapati, then testers decide on the amount of food on which to base the test.

2. After deciding on a cooking task, how the food is prepared should be described and recorded in a way that both stove users and testers can understand and follow. This is important so that the cooking task is performed similarly on each stove. If possible, include a way to measure when the meal is done, like “the skin comes off the beans” or the “the rice is soft”. Recipes and cooking instructions should be recorded on the Data and Calculations form.
3. After all the food and fuel have been gathered and the steps of the cooking task are written up and well-understood by all cooks, the actual testing can begin. **The stove tending and cooking should be done by a local person who is familiar with both the meal that is being cooked and the operation of the stove to be tested.**
4. Record local conditions as instructed on the Data and Calculation form.
5. Do all of the washing, peeling, and cutting as described by the cooking directions recorded in step above. Record the mass of each food in the Data and Calculation form.
6. Start with a pre-weighed bundle of fuel that is more than the amount that local people consider necessary to complete the cooking task. Record the weight in the appropriate place on the Data and Calculation form.
7. Starting with a cool stove, the cook lights the fire in the normal way. Start the timer as soon as the fire is lit and record the time on the Data and Calculation form.
8. While the cook prepares the meal, the tester records any observations and comments that the cook makes (for example, difficulties that they encounter, excessive heat, smoke, instability of the stove or pot, etc). The tester should not take part in the cooking but remain at a distance quietly observing. After the cooking and testing is completed the tester asks the cook to tell him or her about the performance of the stove.
9. When the cooking is finished, record the time in the Data and Calculation form.
10. Remove the pot(s) of food from the stove and weigh each pot with its food on the digital scale. Record the weight in grams on the Data and Calculation form.
11. Remove the unburned wood from the fire and extinguish it. 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. Place all of the charcoal in the designated tray and weigh this too. Record both measurements on the Data and Calculation form. ** If it is not common for cooks to re-use the unburned charcoal and it instead goes to waste, you may choose record zero in the Data and Calculation sheet.*
12. The test is complete. Cooks and testers may now enjoy the food that was cooked or proceed by testing the next stove - each stove should be tested at least 3 times. Wait between tests until the stove is cool. Testers can alternate between the traditional and new stove.

Example of food used in a CCT
(adapted from Baldwin, 1987, p. 94)

<u>Dish</u>	<u>Ingredient</u>	<u>Quantity (g)</u>
Porridge	water	4000
	Millet flour	1000
Sauce:	oil	100
	meat	450
	tomatoes	300
	water	2500
	onions	70
	spices	50

Analysis

The Data and Calculation form includes specific consumption (the fuel used to produce a liter of food) and the time to prepare the food. It is necessary to calculate the average of three tests for

each stove and compare the results. In addition, stoves should be evaluated on the basis of the observations made during each test.

The full-text of the CCT protocol and Data and Calculation Spreadsheets can be found online at www.aprovecho.org