

MECS Controlled Cooking Test (CCT) Protocol

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1 Introduction

This document is designed to guide the reader through a series of Controlled Cooking Tests (CCTs). It aims to gather evidence on the compatibility of local cooking practices with a range of cooking devices and forms part of the Kitchen Laboratory approach, which aims to identify culturally-specific opportunities for transitioning to modern energy for cooking by comparing modern cooking devices with traditional devices across a range of typical dishes. These opportunities can be showcased in an eCookBook and other digestible knowledge products, such as live cooking demonstrations, that are built upon the data collected during these CCTs.

The CCT is a standard test methodology in the clean cooking sector used to compare improved cooking devices with traditional stoves. It aims to balance the repeatability of the Water Boiling Test (WBT) with the range of real cooking behaviours captured by the Kitchen Performance Test (KPT) or Cooking Diaries (DC). It offers a standardised methodology to test the ability of cooking devices to cook specific local foods. Further information on CCTs can be found here: <https://www.cleancookingalliance.org/technology-and-fuels/testing/protocols.html>

The MECS culinary survey¹ offers a structured process for categorising the range of foods that make up the typical local menu. By grouping together dishes with similar cooking processes, an ‘apples to apples’ comparison can be made between different cooking devices using the CCT. Many energy-efficient eCooking appliances are optimised for specific cooking processes (e.g. kettle for boiling), or even specific foods (e.g. toaster for toast). Therefore, understanding what is being cooked and matching these foods with accommodating energy-efficient appliances will be a key enabler for electric cooking in each context. It’s therefore necessary to test each appliance with each category of food, in order to identify the best appliances for each portion of the menu.

This testing methodology is designed to evaluate the relative performance of a range of traditional and modern cooking devices across the full range of dishes that make up a typical everyday menu. This is achieved by using a series of CCTs to measure the energy and time required to cook a representative dish from each category on the local menu and capture the experience of both the cook and the taster. It is set up to record measurements for traditional fuels (e.g. charcoal), modern fuels (e.g. LPG) and electric appliances (e.g. induction stove).

It is assumed that a typology of local foods has already been developed by completing and analysing the MECS culinary typologies survey (or using an alternative method) to develop groupings of popular dishes with similar cooking processes (e.g. tempura and samosa in a deep fried dishes category). The survey seeks to identify the range of dishes being cooked in a regular household, to give some indication of their frequency, and associated cooking processes. A list of relevant cooking devices needs also to be assembled (e.g. induction stove, electric pressure cooker, rice cooker, etc). The table below gives an example of categories of foods in Myanmar defined using the typologies approach. For each category, a representative dish is selected, which will be cooked during the CCTs. During the testing, a set of energy, time and user experience ratings will be gathered for each appliance/dish combination to fill up each cell in the table. It is not possible to cook some types of food in some appliances, for example, deep frying tempura in a toaster is simply not possible. However, others are unconventional, but still possible and therefore should at least be attempted, for example, soup in a rice cooker.

¹ MECS culinary survey spreadsheet available at www.MECS.org.uk

Category	Representative dish	Cooking fuels			Electric appliances							
		LPG	Fuelwood	Charcoal	Hotplate	Rice cooker	EPC	Red Pan	Induction	Infra-red	Electric Kettle	Thermo-pot
Short fry & Simmer	Chicken Curry											
Deep fry	Tempura										X	
Rice	Rice										X	
Boiling water	Green tea											
Boil & simmer	Mohinga											
Short Fry	Sauteed vegetables											

An accompanying spreadsheet has been prepared to guide the reader through the process of setting up the CCTs, recording data and analysing the results. The spreadsheet is designed to capture all the data for a single dish. Each new dish requires a new spreadsheet.

2 Setting up for the CCTs

2.1 Cooks

The cooking should be done by local people, who regularly cook the selected representative dishes and are familiar with the operation of all of the cooking devices. If they have not used any of the cooking devices before, they should first practice cooking the representative dishes with the new device, either at home or in the 'kitchen laboratory'. Only once they are comfortable with cooking the representative dish on the new device should they record their cooking with a CCT.

Each dish should be cooked 3 times on each appliance so that an average reading can be taken to increase the reliability of the results. This can either be the same cook cooking the same dish on the same appliance 3 times, or different cooks cooking the same dish on the same appliance. However, it is important that the mix of cooks stays the same throughout the testing for any one particular dish, i.e. that if 3 separate cooks cook the representative dish on the first appliance, the same 3 cooks should cook the representative dish on each appliance. Otherwise, the results may be biased towards the practices of the cook who cooked that particular dish on that particular appliance.

2.2 Photos

Photos are an important visual record of the testing procedure and will be essential for the preparation of the eCookBook. Photos can be taken using a smartphone or a dedicated camera and should be stored in a sub-folder using the test code for the test they relate to.

Photos can be taken at the following points during each test:

When to photograph	What to photograph	How to photograph
Before cooking	Ingredients	All together and each individually
	Utensils	Different angles to show key features
	The test setup	Include the energy meter, the cooking appliance and the utensil
During cooking (after each step)	Food cooking in the appliance	From above or 45 degrees
After cooking	Finished dish in the appliance	From above or 45 degrees
	Finished dish on serving plate	From above or 45 degrees

Additional photos of the cook during cooking and with the final dish afterwards are also very important for the development of an eCookBook, however consent must be sought from all individuals to be photographed beforehand.

2.3 Selecting pots

A representative pot, pan or other cooking utensil should be selected for each representative dish. This should be the utensil that is most commonly used for this type of dish. Ideally, this utensil should be used for all cooking devices to ensure consistent results. However, some appliances have special requirements (e.g. induction stoves require steel pots), in which case, a utensil that resembles the representative utensil as closely as possible should be selected. Some electric appliances (e.g. rice cooker) come with integrated pots, in which case there is no other option.

The key parameters for each pot should be recorded in the 'Utensils' tab of the MECS Kitchen Laboratory CCT Workbook. This includes if possible, the material, coating, diameter, height, shape and any other distinguishing features. Photos should be taken from several angles.

2.4 About the dish

The 'About the dish' worksheet records qualitative background information on this particular dish and can be completed before cooking begins. This information will be used to introduce the dish in the eCookBook.

2.5 Equipment

The following equipment is required to carry out the CCTs:

Item	Purpose
Flat scale with 5g accuracy	Accuracy defined by LPG measurements, which will be more than sufficient for weighing biomass fuels and food
Timing device	Smart phone or clock ok for timing
Plug in energy meter	Able to record cumulative kWh during electric cooking recipes
Cooking pots	For cooking devices without integrated pots
Cooking devices	To be testing
Ingredients	For each dish to be tested
Other kitchenware	Any other kitchen utensils that may be required to prepare the ingredients (e.g. knife)
Laptop to record data	Can also be a notepad if laptop not available
Camera	Can be smart phone
Measuring tape	To measure pot
Extension cable (optional)	To make the testing set up more flexible - ensure the extension cables are rated for high power appliances
Plug adaptors (optional)	To make the testing set up more flexible - ensure the adapters are rated for high power appliances
Cooking fuels	Enough fuel to complete all the testing, plus an extra 20% in case some of the tests need to be redone
Metal tray	To hold charcoal for weighing.
Small shovel	To remove charcoal from stove for weighing.
Heat resistant gloves	To hold shovel & tray.

2.6 Ingredients & recipe

A standardised recipe and ingredients list should be agreed by those who will be doing the cooking.

The recipe should be simplified, identifying the key points where measurements should take place. The recipe should first be written down as a full narrative recipe, typical of what you might see in an ordinary cookbook. This should then be categorised by separating out the non-cooking processes, cooking process, ingredients added and end point of each step. A new step should be added each time the cooking process changes (e.g. from boiling to frying) or when a batch is completed (e.g. finishing a pancake). The end point is particularly important, as it defines when measurements should be taken. End points should be clearly observable (e.g. the beans can be easily squashed between your fingers), rather than subjective (e.g. they smell right). Finally, the recipe can then be simplified into the cooking process and end point, with a step number added. This simplified

recipe can then be copied and pasted into the ‘eCooking CCT lab book’ and ‘Fuels CCT lab book’. An example of this process is given below for pancakes.

Narrative recipe	Categorised recipe				Simplified recipe		
	Non-cooking processes	Cooking process	Ingredients added	End point	Step no.	Cooking process	End point
<ul style="list-style-type: none"> Mix together all the ingredients in a bowl Preheat the pan to medium heat and add a little oil Add the batter and cook until starting to brown, then flip over and cook until the other side is also brown Remove the first pancake, then add more batter to start the next Repeat to make another pancake ... 	Mixing						
		Pre-heating			1	Pre-heat	Pan feels hot
		Shallow frying	Batter	When second side browned	2	Shallow fry	2nd side brown
		Shallow frying	Batter	When second side browned	3	Shallow fry	2nd side brown
		Shallow frying	Batter	When second side browned	4	Shallow fry	2nd side brown

Set quantities for the recipe should be agreed. This is not straight forward, as some dishes are ‘one pot meals’, whilst others are typically served as side dishes. Although the cooked food will be weighed at the end of the test, so the energy consumption can be normalised by weight of cooked food, the quantity cooked will influence the performance of the stove to some degree. However, to be pragmatic, it is suggested to cook sufficient to serve 4 people in the way that it is typically served, as this is likely to fill most household-sized cooking utensils around mid-way.

3 Carrying out the CCTs

3.1 Preparing the ingredients

To save time, the ingredients for all CCTs to be carried out that day can be prepared in advance. Scales should be used to divide each ingredient up into the quantities specified in the ‘Ingredients’ worksheet. Preparation time is not recorded in the CCT, only time where cooking (heating of food) is actually taking place).

3.2 Preparing the fuels and measurement equipment

Cooking fuels should be weighed using the scale and recorded in the ‘Fuels CCT lab book’. Plug-in energy meters should be zeroed. The cooking device should be cool – if performing multiple tests in a row on the same device, sufficient time should be allowed for it to return to room temperature.

Each test should be given a code – for example, the first test for pancakes cooked on an infra-red stove could be called ‘Pan-Inf-1’.

3.3 During cooking

At each step in the simplified recipe, the time should be recorded in an ‘eCooking CCT lab book’ or a ‘Fuels CCT lab book’ and for electric appliances, the reading on the energy meter at each stage. For cooking fuels, energy measurements are only taken at the start and end of the CCT. The first reading should take place as soon as the cooking device is lit or turned on. As some cooking devices require time to preheat or light, the time when cooking actually begins should be recorded as the second step. Subsequent readings should then be taken when the end point of each step in the simplified recipe is reached.

If anything occurs during the cooking process that may affect the results (e.g. a short blackout, or missing one of the end points by a few minutes), this should be recorded. Comments can be made beside each step, or any issues that may affect the test as a whole can be reported in a separate box at the end.

The final weight of the cooked food should be recorded. The food can be weighed in the utensil it is cooked in and the weight of the utensil subtracted.

The final weight of the unused cooking fuel should also be recorded so that it can be subtracted from the initial weight to calculate the fuel burned during the test. For biomass stoves, any partially burned fuel should be placed into a metal container using a small shovel whilst wearing heat proof gloves. It should then be weighed and recorded so that it can also be subtracted from the initial weight.

3.4 After cooking

The experience of the cook and of those tasting the food should be recorded. If an enumerator is recording data whilst the cook cooks, they can question the cook about their experience whilst they cook. However, the tastiness of the final dish can only be evaluated after cooking has finished.

A simple rating scale has been devised for both the cooking experience (above) and the tastiness of the final dish (below):

Rating	How easy is it to prepare this dish with this appliance?
1	Very difficult
5	Some issues, but no more than usual
10	Very easy

Rating	How tasty was the finished dish?
1	Inedible
5	Edible, but not as tasty as usual
10	Delicious - as tasty as usual (or better)

The tastiness can be evaluated by the cook themselves, or a separate taster. If a separate taster (or panel of tasters) is involved, they should be a local person who frequently eats that representative dish. They should also

taste all of the dishes cooked by that cook in that session (i.e. the same dish cooked on different appliances). Otherwise, this could introduce a similar bias to having different cooks as explained above.

In addition to the quantitative rating, the qualitative experience of the cook and the tasters should also be captured in as much detail as possible. The experience of the cook should capture the key points that they liked and disliked about cooking that dish on that appliance. The experience of the taster should cover the taste, texture, smell and appearance of the finished dish, with reference to how they expect that dish to be when cooked at their home.

3.5 Data analysis

Data analysis is not covered in this protocol, however the MECS Kitchen Laboratory reports (e.g. [Myanmar](#), [Zambia](#), [Uganda](#)) offer practical examples of how to analyse the data from CCTs. The [MECS eCookBooks](#) show how this data can be presented in an engaging format.