

Electric pressure cookers for large scale and institutional cooking: the Tanzanian experience with a 40L EPC



By Katarina Aloyce & Anande Ngaya

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Table of Contents

Acknowledgements.....	3
Author contact details	3
1. Introduction	4
2. Testing common Tanzanian foods	4
2.1. Rice.....	5
2.2. Beef stew.....	5
2.3. Kande	7
2.4. Ugali	8
2.5. Banana stew	9
2.6. Yellow beans stew.....	10
3. Summary of key data	11
4. Further observations by the cooks	11
5. Suggestions for improvement.....	12
6. Conclusion and recommendation	12
References	13
Annex 1: Report from A2EI on the smart meters used to monitor Large EPC testing for some dishes at TaTEDO Large EPCs testing facility.....	14

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Author contact details



Centre for Sustainable Energy

TaTEDO
P.O. Box 32794
Dar es Salaam
E-Mail: energy@tatedo.or.tz; Website: www.tatedo.or.tz
Phone: (+255) 738 201498; Fax: (+255) 22 2774400

The authors are two EPC expert cooks, who have years of experience cooking on 6 L EPCs and training others.

All photos belong to TaTEDO.

1. Introduction

Cooking with electricity in an electric pressure cooker (EPC) in Tanzania at the household level is nowadays gaining acceptance, to a high extent due to awareness raising activities and efforts that have been made to eliminate barriers for the uptake of modern energy cooking services. Taking into consideration only EPCs supplied through TaTEDO and SESCO efforts, in collaboration with other stakeholders (especially associated MECS projects), more than 1000 households in rural and urban areas are currently using EPCs for cooking in Tanzania.

There is a massive dependence on biomass energy, especially firewood, for cooking in most schools and institutions in Tanzania. One example of a real situation is Mnolela Secondary School, a school in Southern Tanzania. The school was marked as one of the institutions that really needed support to improve the energy efficiency in its energy requirements after an energy baseline survey was conducted through the Sida-WWF 'Leading the Change project'. The efforts undertaken by TaTEDO in collaboration with the stakeholders managed to cut down the consumption of firewood by 70% using improved institutional stoves¹. As we all know, improved biomass stoves are the transitional solution. However, with larger EPCs, there is hope to completely eliminate this massive environmental destruction, save precious time for students to collect firewood, improve health and other associated risks.

The use of EPCs for cooking have been an effective way to solve the challenges posed by the use of biomass energy for cooking. The increasing availability of larger EPCs opens up other opportunities for using electricity for cooking in institutions and places where large amounts of food are being cooked.

This report captures preliminary results of the tests undertaken on a 40 litre EPC to evaluate how well it can fit common Tanzanian recipes in institutions and for catering services entrepreneurs. Several tests were performed on water boiling and cooking of some common Tanzanian staple foods which are commonly served in such institutions. Such foods which were tested include, ugali, rice, Kande, beef stew, beans stew and banana with beef.

The results presented in this report and summarised in table 2, provide good reason to introduce and promote the large EPCs due to its low energy consumption and now proven capability of cooking large amounts of food safely and to high quality.

2. Testing common Tanzanian foods

Preparations for testing started with installation of the sockets with electric capacity to suit the rated power (3600W) and fixing a top plug of 15A, since the device came without a top plug. All decisions were made considering the Tanzania grid which operates at 220 -240 volts.

Before starting cooking common Tanzanian foods, the EPC was tested by boiling water at different volumes. It was observed that the maximum capacity is only 32L not 40L as labelled, and the maximum amount of water that could be boiled without any challenge was 28L. On exceeding this amount, the pressure release valve released some pressure while boiling.

In the following sub-sections and results, the amount of food, water and estimations of time to cook particular foods were derived from the established standards to cook Tanzanian staple foods in a

¹ https://wwf.panda.org/wwf_news/?343810/SCHOOL-CUTS-DOWN-FIREWOOD-CONSUMPTION-BY-70-WITH-AN-IMPROVED-COOKING-STOVE

family size EPC of 6 litres. The test of each food is summarized here and Table 2 summarizes the key data.

2.1. Rice

Rice is a very common food and is easy to prepare with EPCs. The recipe for the test which was undertaken is given below:

Ingredients

- 5 kg (8 cups) rice
- 15 cups of water
- 250 ml vegetable oil
- 2 tablespoons salt

Procedures followed

All unwanted particles were removed from rice and it was washed. Normal procedures for cooking rice in an EPC were followed, whereby all ingredients (rice, salt, oil and water) were mixed together. The button for cooking rice was selected, whereupon the display showed 35 minutes of pressure cooking. The total time for heating and pressure cooking was 60 minutes and it consumed 1.3 kWh.

Recommendation

The 40L EPC can be the perfect choice for institutions with small numbers of people and food vender entrepreneurs, since we estimate it can cook only 12kg of rice.

For large institutions like schools, larger EPCs would be required, or multiple 40L EPCs.

It is very easy to cook rice in it and the results were superb.



2.2. Beef stew

Ingredients

- 5 kg beef
- 5 onions, 5 carrots, 5 bell peppers, 10 tomatoes, 10 potatoes
- 1 tablespoon garlic and ginger paste
- 2 tablespoons salt
- 100 ml cooking oil

Procedures followed

The procedures for cooking beef stew on a small EPC were followed. The only thing that was done differently (apart from the timings offered by the device) was to set 15 minutes of pressure-cooking time for the spicing stage. This is described in more detail below.

We started with boiling the beef using the beef button which is set for 35 minutes. The heating to reach pressure took 15 minutes, thus making the total time for boiling 50 minutes.

Then the lid was taken off and the spicing stage began. The pressure-cooking time set for spicing was 15 minutes, which led the beef to overcook a little bit. On small EPCs we normally use 5-10 minutes for spicing depending on the tenderness of the meat after the boiling stage. The idea of using 15 minutes for the large EPC came from the logic that the button for boiling meat under pressure on the large EPC is set for 35 minutes, while on a small EPC it is set for 20 minutes. So, if the beef was boiled for 35 minutes and did not overcook, then other ingredients (onions, carrots, bell pepper, tomatoes and potatoes) which were added in large quantities should need more time compared to the small EPC as well.

Coconut milk was added after the pressure-cooking stage was finished. The total time for spicing took 40 minutes where 20 minutes were for heating up to reach pressure, 15 minutes for pressure cooking and 5 minutes with the lid open for the coconut milk to boil.



Recommendation

Cooking beef on the large EPC was easy, convenient, and also tasted good.

In large institutions beef is not cooked in large quantities in comparison with other foods like beans. The 40L EPC might be small for schools, but perfect for restaurants, hotels, caterers and institutions with small numbers of people where they eat meat regularly.

The schools and institutions with large numbers of people might require larger EPCs or multiple, since the estimated amount that can be cooked on this size is 10-12 kg. This estimate is derived from the experience of cooking 5 kg in the test.

2.3. Kande

Kande is a traditional food prepared mostly in schools and large institutions. The fact that it takes a long time and a lot of energy to cook means it is not regularly prepared, and when prepared is a special meal to some restaurants and hotels.

Ingredients

- 2 kg pounded maize
- 2 kg yellow beans
- 25 cups water
- 8 carrots, 4 bell peppers, 8 onions
- 2 tablespoons salt
- 300 ml cooking oil
- 5 cups coconut milk

Procedures followed

The maize and beans were boiled with the time set for 60 minutes as for the small EPCs. The time taken to reach pressure was 50 minutes, making the total time of 110 minutes for just the boiling stage. The spices were added and spicing was done for 47 minutes (37 minutes for boiling and 10 minutes for pressure). Coconut milk was then added and boiling with an open lid continued for 15 minutes. The estimated time for cooking Kande on a large EPC for this quantity is about 2.5 to 3 hours depending on the time that will be wasted between one stage and the next.



Recommendation

We highly recommend this EPC for preparing Kande in large institutions. It is convenient and can be left unsupervised.

Electricity consumption is 3.67kWh, which is equivalent to 1,285 Tsh. It is economical compared to other fuels in all aspects and it tastes more delicious.

2.4. Ugali

Ingredients

- 8 kg maize flour
- 16 L water

Procedures followed

The water was brought to boiling point with the lid on. 3 cups of flour were added in a bowl, mixed with little cold water and stirred well with a wooden spoon. The solution was then poured to the boiling water, stirred well and let to boil for 10 minutes (with the lid off).

The rest of the flour was added in portions and stirred well until it became firm. We continued to mix and press it against the walls of the cooking pot until all flour was mixed in. The cooking pot was covered with its lid and let to cook for 15 minutes.

In the stirring step two people were required, whereby they stood at right angles to each other and used small wooden spoons (spatulas) to pound the ugali against the sides of the pot. In a school, a very large spatula would be used and it was evident that if used in the large EPC, the device would not be stable and potentially move around or tip over. The other effect of the stirring was that the pot spun around within the EPC housing, knocking against the sides of the housing. It is possible doing this frequently would damage either the pot or the housing, so this was felt to be a problematic aspect of cooking ugali on the EPC. For a small EPC, the cook can hold the EPC in one hand and stir with the other. However, for the large EPC, two hands were needed for each spatula, so keeping the EPC steady is more problematic.

The resulting ugali tasted as normal and sufficient for 70 people.



Recommendation

Ugali was not a natural fit to the large EPC, unlike all the other recipes. The stirring of the ugali risks unbalancing the device and the resulting spinning of the inner pot may damage the housing and pot. This is a problem because schools cook ugali very often, and the fact it is not so easy to cook ugali on the large EPC compared to standard methods means schools might be unlikely to switch to using the large EPC for ugali. Further research would be required on this point.

2.5. Banana stew

Banana is a traditional food but is not commonly prepared in large institutions. There might be a use case for caterers and big restaurants.

Ingredients

- 20 L bucket of peeled bananas
- 3 kg beef
- 6 large carrots, 5 bell peppers, 8 onions
- 2 tablespoons salt
- 300 ml cooking oil
- Coconut milk

Procedures followed

The same procedure was used as is used in a small EPC, as summarised by the following table.

Table 1: Table summarizing some detailed data on making banana stew.

Action	Time set (pressure cooking time)	Total time spent	Electricity consumed (kWh)
Beef boiling	25 minutes	40 minutes	0.35
Boiling banana mixed with the boiled beef and other spices	15 minutes	53 minutes	1.68
Open lid boiling (for coconut milk)	15 minutes	15 minutes	0.64



Recommendation

Using the large EPC was easy, convenient and efficient when cooking banana.

The targeted market can be large restaurants and caterers serving for large numbers of people and for ceremonies.

2.6. Yellow beans stew

Beans are a dish very commonly prepared in institutions, especially in schools. Some schools make it daily. Beans normally take a long time to cook and consume a lot of fuel. On using EPC, the experience is faster and much easier.

Ingredients

- 5 kg yellow beans
- 25 cups water
- 10 sizable carrots, 5 bell peppers, 10 onions
- 2 tablespoons salt
- 400 ml cooking oil
- 5 cups coconut milk

Procedures followed

The normal recipe for a small EPC was followed. 5kg beans were boiled with 25 cups of water, which took about 2 hours. The electricity consumed was 3.1 kWh which is equivalent to 1,085 TSH as indicated in table 2.



Recommendation

Highly recommended for cooking beans in schools and large institutions.

This will help to save time, money and allow students who are involved in firewood collection get enough time to concentrate with their studies.



3. Summary of key data

Table 2: Summary of data for cooking particular food, electricity consumed and the costs (using current tariff of 350 TZS/kWh)

Type of food/test	Amount of food	Amount of water (cups/Lt)	Cooking time (min)	Electricity consumed (kWh)	Costs (electricity) in TZS
Water boiling	28 L (Max level)	N/A	56	3	1,050
Water boiling	20 L	N/A	45	2.4	840
Rice	5 kg	15 cups	60	1.3	455
Beef Boiling	5 kg	N/A	50	1	350
Beef stew	5 kg	N/A	90	2	700
Kande	4 kg (2 kg beans, 2 kg pounded maize)	25 cups	172	3.67	1,285
Ugali	8 kg	16 L	110	3.37	1,180
Banana stew	20 L (full bucket)	N/A	125	2.67	935
Beans stew	5 kg	25 cups	122	3.1	1,085

4. Further observations by the cooks

The following list captures the expert assessments of the large EPC from the cooks' own experiences, and any other EPC features not yet mentioned.

- The EPC received by TaTEDO is labelled as of 40L, while on measuring it is only 28L to the maximum level mark, and 32L right to the top. This loss of volume is important because schools will require larger EPCs or multiple EPCs to prepare enough food.
- When cooking at pressure, if large quantities were in the pot, the pressure valve released pressure at various intervals. This is a potential safety hazard for untrained cooks, but can be mitigated through training cooks to never put their hands over or lean over the pressure release valve.
- It is necessary to be extra careful while cooking since the lid gets very hot. Someone without experience might not know the EPC is on, approach it, and get burned if they touch the lid.
- The ergonomics of EPC placement requires careful attention. Using it on normal height kitchen tables or counter tops means that it is too high, which makes it difficult to access the pot and perform the cooking actions. Many schools using biomass stoves would place these on the floor, but that could also be a hazard with the large EPC as people would be more likely to lean over it or on it during cooking and get burned. It would be better to place it at half the normal height.
- The second point on ergonomics was that cooking ugali (although there were drawbacks as discussed above) was easier when the EPC was placed at the corner of a raised surface so that the two cooks could stand at right angles to each other. This helped to balance the pot during the stirring phase. This was not necessary for any of the other foods.

- A 10-litre bucket was found suitable for the scale of water quantities required.
- Note that the pot of the large EPC is too large for washing in a sink. This is however not a problem as most large pots are washed outside anyway.
- Energy savings could be made by using pre-heated water when required. However, if this is done for beans, it is wise to be careful. Experience has shown that using hot water reduces the soaking time of the beans that happens during cooking as the pot takes a shorter time to get to pressure. This should be compensated using a slightly longer pressure-cooking time, or by pre-soaking the beans beforehand.

5. Suggestions for improvement

- Being able to use the EPC on a normal socket would make uptake across schools and institutions easier. This could be an area of product improvement.
- The lid could be insulated to avoid heat loss and so conserve energy. In addition, a more insulated lid would avoid the risk of injuries due to burns.
- Any product design improvement which retains functionality but which reduced its weight would be highly advantageous, so that cooks can handle it more easily (for example, when taking it to the serving area).
- A more accurate naming of the device to reflect the actual capacity possible would be useful so as not to disappoint the user.

6. Conclusion and recommendation

It was a great experience testing the large 40L EPC with some common Tanzania foods. It is highly recommended especially for kande, beans, meat, rice and banana. There are some reservations about the potential to cook ugali with the large EPC due to the high effort required and the potential for the device to be damaged due to the frequent stirring. The tests show that the large EPC is a viable solution for schools, catering services and large institutions in terms of efficiency, time saving, improving health and the large portions of food that can be prepared in it. We recommend that the next stage involves trials in candidate institutions and involvement of cooks from those places.

References

- Batchelor, S. (2021) "Large Electric Pressure Cookers; Are they a possibility for institutions?". UK
- Aloyce, K. and Sawe, E. (2020) "The Tanzania Ecoobook". TaTEDO, Tanzania.

Annex 1: Report from A2EI on the smart meters used to monitor Large EPC testing for some dishes at TaTEDO Large EPCs testing facility.

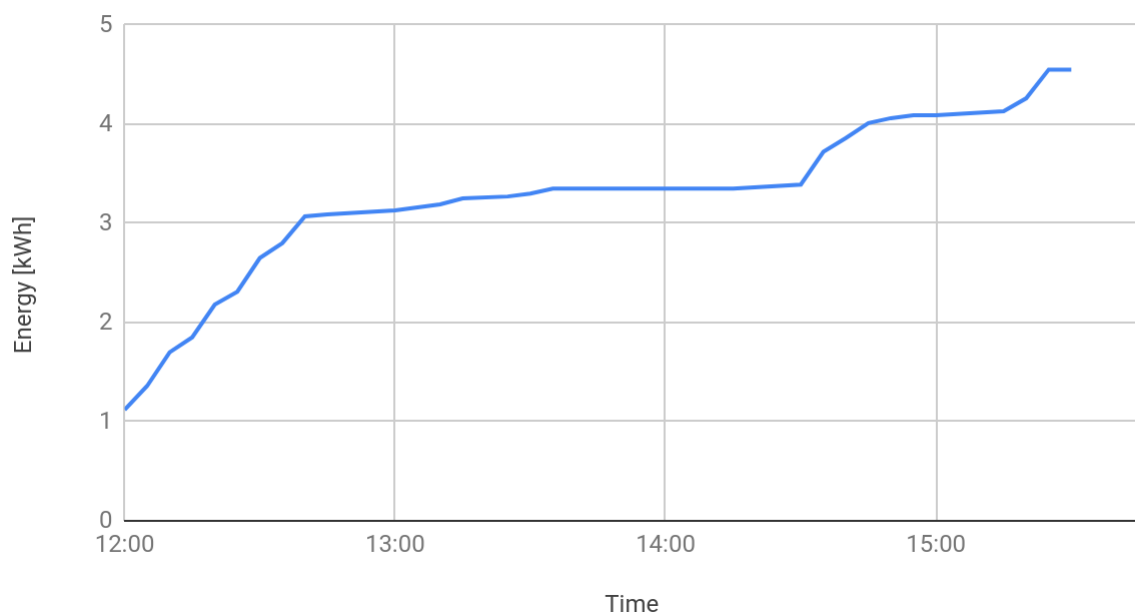
Access to Energy Institute (A2EI)

TEST RESULTS AS SEEN FROM OUR SERVER

Author: Joseph Bundala

Maximum Current (A)	14.1
Maximum Voltage (V)	227.3

Energy Consumption on EPC Usage



Cooking Events	Energy Consumption (kWh)
Boiling	2.47
Spicing Up	1.20
	3.67

Total Cooking Time: 3 hours, 45 minutes.

Water Boiling 12.05.2021

Cooking Time (minutes)	Energy Consumption (kWh)
50	1.78

Ugali - 17.05.2021

Cooking Time (minutes)	Energy Consumption (kWh)
110	3.37

Ndizi (banana stew) - 19.05.2021

Cooking Time (minutes)	Energy Consumption (kWh)
125	2.67