

Prospects for the Caldera Heat Battery Cooker

December 2020, Caldera shared a prototype version of their Heat Battery Cooker. This was used in a UK household context but with the understanding that the core markets for the device are to be found in Low and Middle Income countries. This note by S Batchelor, Research Coordinator for Modern energy Cooking Services (UK Aid) and Director of Gamos, captures impressions and data from its first use.

Context:- “Progress towards ensuring access to modern cooking solutions, a key component to achieving Sustainable Development Goal 7 (SDG 7), has been slow. Today, 2.8 billion people globally still cook with traditional polluting fuels and technologies, costing the world more than 2.4 trillion dollars each year, driven by adverse impacts on health (1.4 trillion dollars), climate (0.2 trillion dollars), and women (0.8 trillion dollars from lost productivity). Solutions to tackle this pressing development challenge must prioritize user preferences and local cooking contexts to address longstanding barriers to the adoption of modern cooking solutions.” ESMAP.2020. The State of Access to Modern Energy Cooking Services (English). Washington, D.C.: World Bank Group. <http://documents.worldbank.org/curated/en/937141600195758792/The-State-of-Access-to-Modern-Energy-Cooking-Services>

Households connected to the national grid, or to a substantial minigrid, often have limitations on how much power they can draw. Peak loads and peak demand are often already up to the limits of the generating system, and adding substantial cooking loads would create power outages at key moments when the demand exceeds the supply. While 2.8 million cook with polluting fuels, there are 800 million who do not yet have connections to national grids. For them the cost of solar PV panels has reduced dramatically over the last 20 years, such reduction being due to learning and scale and this is expected to continue. This has led to a plethora of solar home systems, pico solar home systems, and PV based minigrids, used mainly for lighting and low power devices such as television and phone charging. The price point for possibly using solar PV for cooking has only recently been feasible. However, people wish to cook in the evening, and so energy storage is requisite for a viable solar PV cooking system. While chemical batteries have also come down in price, and such a trend is likely to continue they often contain chemicals that are difficult to dispose of, and there are increasing fears of a legacy of chemical waste.

The Caldera Heat Battery Cooker introduces an as yet untried approach.

<https://www.caldera.co.uk/> <https://www.clean-cooker.com/>

Product:- Its primary point of attraction is that it presents a mechanism for **energy storage** to leverage and time shift modern energy. It can work with either weak delivery of national grid or time specific generation of power by renewables (such as Solar PV but the same would be true of micro hydro or wind) to deliver a cooking experience that can match the many different cultural demands of cooking while using completely safe materials that can be recycled at end of life.

For this first assessment the heat battery was charged from a power supply fed by the UK grid. A steady supply of 310W brought the core of the battery from room temp to 365C over slightly more than 7.5hrs. Given the case study below, it should be noted that it is likely to begin its recharge each day at around 140C rather than room temperature. The system sizing, matching the PV array to the energy storage has yet to be optimised, by the company are well on their way to modelling and learning this.

Conclusion – this is very attractive as an option for weak grid and off-grid cooking. It is a Tier 5 stove, with no household air pollution, and can be used with minimal carbon emissions. It is also potentially environmentally friendly for disposal (or reuse) at its end of life. It is intuitive and can accommodate many different cultural cooking styles.

One to watch.

Case Cook – Steak and Chips supper, with Breakfast tea and reheated chapati

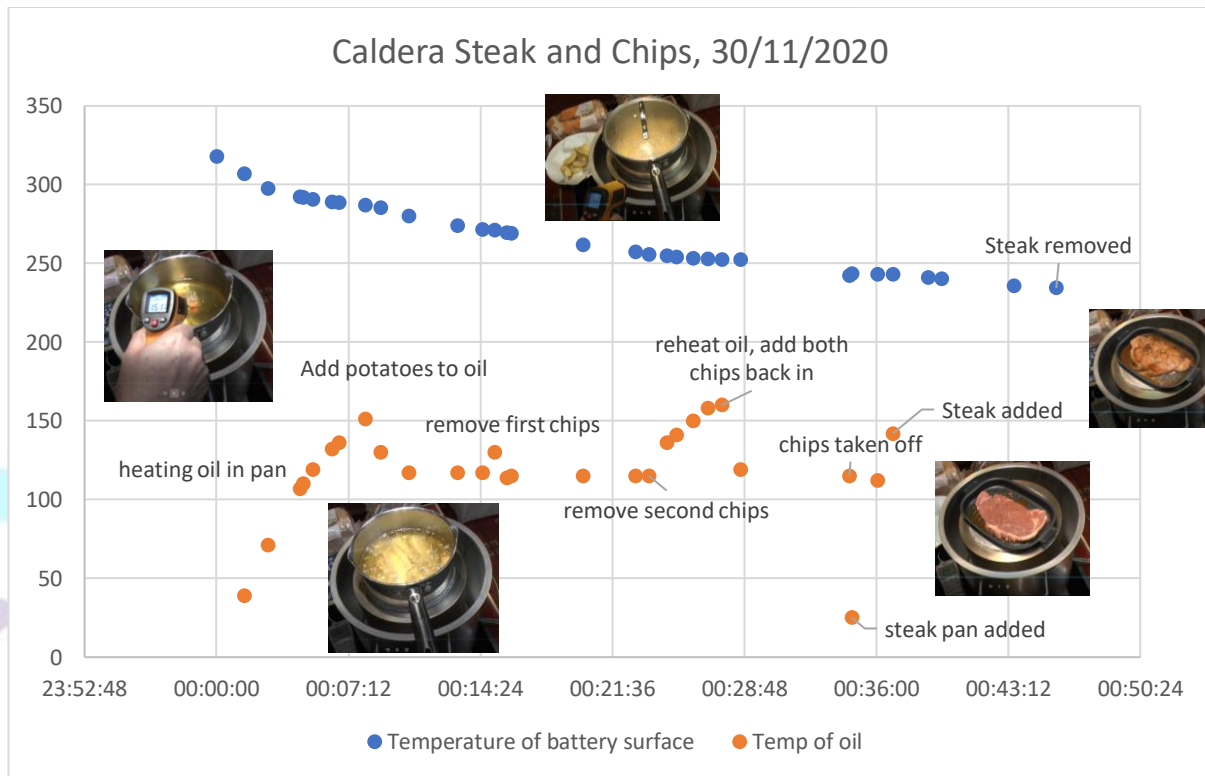
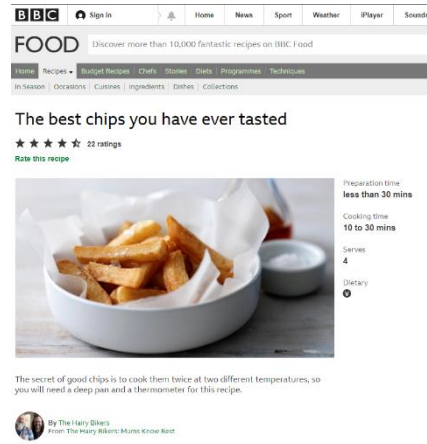
(ie a conservative two meals from a single charge)

The flexibility of the design is such that it can accommodate many different cooking styles. Obviously some cooking styles are more energy efficient than others. A stew made with the insulation cover over the pot will use the energy efficiently. However, energy efficient use depends greatly on behaviour of the cook, and the culture of the cooking.

As a case example, UK cooking tends to be about meat or fish, and chips. The charged Caldera was easily able to double cook two plates of chips and a steak.

https://www.bbc.co.uk/food/recipes/thebestchipsyouhavee_93121

However, note....as a cook I was slightly impatient on the chips.



The overall energy consumption was 0.75kWh, which is what we might expect from cooking with electricity and using the same pans. The temperature of the heat battery reduced from 315C to 234C. The cover was placed and left over night – reducing the temp of the heat battery further to 206C. This was enough to cook 1 litre of tea (including a long 'Kenyan' simmer of Chai), and to reheat chapatis for breakfast. The final heat battery temp was 154C, which might now be recharged during the day.

