



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

**ScienceDirect**

Energy Procedia 123 (2017) 228–234

Energy

**Procedia**

[www.elsevier.com/locate/procedia](http://www.elsevier.com/locate/procedia)

1st International Conference on Sustainable Energy and Resource Use in Food Chains,  
ICSEF 2017, 19-20 April 2017, Berkshire, UK

# Energy embodied in household cookery: the missing part of a sustainable food system? Part 2: A life cycle assessment of roast beef and Yorkshire pudding

Christian J. Reynolds<sup>a,b\*</sup>

<sup>a</sup>University of Sheffield, Department of Geography, Faculty of Social Sciences, Winter Street, Sheffield, S3 7ND, UK

<sup>b</sup>University of South Australia, Division of Information Technology, Engineering and the Environment, Adelaide, SA, 5001, Australia

---

## Abstract

This paper firstly reviews the current state of knowledge on sustainable cookery and the environmental impacts of the food consumption phase. It then uses the example of a dish of roast beef and Yorkshire pudding to explore energy use in food production and consumption. Part 1 of this paper conducts a meta-analysis of 33 roast beef and Yorkshire pudding recipes in order to create a representative recipe for analysis. Part 2 of this paper then uses life cycle assessment and energy use data is coupled with the representative recipe of roast beef and Yorkshire pudding, to calculate the embodied energy of the meal. Seven interventions are modelled to illustrate how sustainable cookery can play a role as part of a sustainable food system. Interventions show that sustainable cookery has the potential to reduce cookery related energy use by 18%, and integrating sustainable cookery within a sustainable food system has the potential to reduce the total energy use by 55%. Finally, the paper discusses the issue of how the adoption of the sustainable cookery agenda may help or hinder attempts to shift consumers towards sustainable diets.

© 2017 The Authors. Published by Elsevier Ltd.

Peer-review under responsibility of the scientific committee of the 1st International Conference on Sustainable Energy and Resource Use in Food Chains.

*Keywords:* Energy demand and resource use in food consumption; life cycle assessment; cooking; home-made meals; Environmental impacts; LCA; food; meal; food energy and water nexus; energy and resource use in food consumption

---

---

\* Corresponding author. Tel.: +44-7448-934888.

E-mail address: [c.reynolds@sheffield.ac.uk](mailto:c.reynolds@sheffield.ac.uk)

## 1. Introduction

Part 1 of this paper provided a general introduction into energy use in household cookery and provided method to calculate a representative recipe that would describe the current cooking methods, and portion and ingredient norms. This representative recipe can then be couple with life cycle analysis tools to show the environmental impacts of the recipe (food and cooking method)

In this paper (part 2), I couple life cycle assessment data with the recipe of roast beef and Yorkshire pudding to explore the energy use in food production and consumption. In part 1, I conducted a meta-analysis of roast beef and Yorkshire pudding recipes to create a representative recipe. To illustrate how sustainable cookery can play a role as part of a sustainable food system, in this paper (part 2), I model how seven possible interventions impact on energy use within the context of this recipe. Interventions include different cooking methods, ingredient change, and increasing appliance efficiency.

## 2. Methods

### 2.1. Life cycle assessment

Embodied energy use data for ingredients was sourced from the Williams, Audsley and Sandars 2006 report [23]. This provided the primary energy used (MJ) for UK conventional and organic production of bread wheat, beef, eggs, milk, and oilseed rape. A processing/conversion rate of 40% was used to convert the oilseed rape to oil [30]. Embodied energy use data for ingredients was also sourced from the 2013 report by May, Adams, and Plackett [13] to provide comparison of primary energy use compared with energy use of ingredients across the full supply chain (primary production, processing, transport, packaging and storage/retail). The energy factors of beef were used as a proxy for dripping as both ingredients come from the same production process.

Household product level (avoidable) food waste data for each ingredient was sourced from a 2014 WRAP report [16]. Energy consumption data for UK domestic appliances (ovens and stove tops) was sourced from Wood and Newborough [24]. Ovens were assumed to have been preheated for 20 minutes to come up to cooking temperature [25]. As no recipe specified refrigeration or storage prior to cooking, this set of energy use assumptions were not included in this assessment. The functional unit for the assessment was firstly “per portion of roast beef and Yorkshire pudding”. However, as cooking times (and thus energy consumption) vary by weight of joint, 8 portions (the median number of portions per recipe) was selected as the representative functional unit of this analysis.

### 2.2. Scenario analysis

In addition to calculating the energy required to produce and cook a typical (median) roast beef and Yorkshire pudding, seven additional scenarios are investigated. In all scenarios the ingredient energy use data is sourced from the Williams, Audsley and Sandars 2006 report [23]. The assumptions and data sources are outlined below.

1. *Low heat cooking method:* As discussed in the results, a subset of the recipes featured searing the joint of beef in a pan and then transferring the beef to a low oven (55-60C) until the internal core temperature of the joint was between 55-60C – i.e.240 minutes. The Yorkshire puddings are then cooked in a hot oven (220C). The energy use for the low oven method is sourced from Wood and Newborough [24], with 1.2kWh rather than the 2kWh of a hot oven. The searing is assumed to use an electric stove/hotplate (0.6kWh) [24].
2. *Sous vide cooking method:* For this paper the sous vide method can be understood to be the placing the joint of beef in a vacuumed plastic pouch/bag and submerging this in a heated water bath for several hours until the internal core temperature of the joint was between 55-60C – i.e.500 minutes [26]. After this time, the joint is then unwrapped and placed in a hot skillet (0.6kWh) to sear the joint’s surface [24]. The Yorkshire puddings are then cooked in a hot oven (2kWh). This water bath is heated by a sous vide appliance (such as an immersion circulator). Energy consumption data for sous vide appliances was sourced from an internet test website that has

Download English Version:

<https://daneshyari.com/en/article/5444664>

Download Persian Version:

<https://daneshyari.com/article/5444664>

[Daneshyari.com](https://daneshyari.com)