Energy embodied in household cookery: the missing part of a sustainable food system?

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1st International Conference on Sustainable Energy and Resource Use in Food Chains

Who am I?
Knowledge Exchange Research Fellow
(N8 AgriFood project, Theme 3: Improved nutrition and consumer behaviour)

Research areas:
• Healthy Sustainable Diets and Food Consumption
• Food Waste
• Household food insecurity
• Eating out/takeaway
• Food Price

Greenhouse gas emissions associated with sustainable diets in relation to climate change and health

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Proceedings of the Nutrition Society (2015), 74 (OCE5), E351
doi:10.1079/0029665115003985

Nutrients 2014, 6, 2251-2265; doi:10.3390/nut6062251
www.mdpi.com/journal/nutrients

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Climate change and diet

UK food system 9% -20% of total UK GHGE from agriculture/food system.

Paris Targets
57% reduction from 1990 values by 2032, and an 80% reduction by 2050

4.14 kgCO₂e/person/day reduced to 1.78kgCO₂e/person/day (57% reduction)

Dietary, habitual, and technological change is needed.

… So let’s get cooking!
We need to shift to a sustainable diet

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The UK Diet is changing…

Source: DEFRA Family food open data
https://data.gov.uk/dataset/family_food_open_data
How (and where) we purchase and eat food is changing…

UK grocery industry in the last 40 years

Online deliveries
5% of market share could be 20% by 2025

75% of the population eating out of home at least once in seven days in 2014, rising from 65% in 2010.

UK % market share of supermarkets – Groceries market (yearly average values).

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How methods we use to cook food have not changed in forty years...

Ovens
Stoves (Boil, Fry, Steam)
Grill
Microwaves
Sous Vide (?)

Is the way we cook be the last thing to change?
Change how we cook and eat, change peak demand

Roast beef and Yorkshire pudding

A way to understand the food system today.
Pick a recipe?

Old England Traditional Roast Beef and Yorkshire Pudding

★ ★ ★ ★ ★ (3)
READY IN: 3hrs 45mins

Recipe by French Tart

Possibly the most famous of all English dishes, traditionally served for the "big" family meal of the week, Sunday Lunch. First a little about the Yorkshire Pudding. Different areas of England cook, serve and eat this in totally different ways. No single way is 'right' nor 'wrong'. It depends upon your family tradition and where you live. Originally the Yorkshire ... More
Solution: Meta analysis of recipes

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Typical/Common ingredients
Beef, Eggs, Flour, Milk, Water, Fat

Median: 8 Portions (Leftovers?)
Typical ingredients: use median values (per portion)

- Beef: 250 g
- Dripping: 7 g
- Egg: 25 g
- Flour: 28 g
- Milk: 43 ml
- Water: 15 ml
- Oil: 4 ml
Different ingredients have different environmental impacts

Embodied Energy use/LCA data from

Energy use data for household cooking appliances is difficult to source...

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<tr>
<td>Sous Vide</td>
<td>Average after first hr:0.25 (First Hour Power Use: 0.47)</td>
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Sources:
Multiple cooking scenarios

1. **Hot oven**: Roast beef and Yorkshire puddings in a hot oven (220c).

2. **Low heat cooking method**: sear the joint of beef in a pan and transferred 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 cooked in a hot oven (220c).

3. **Sous vide cooking method**: place joint of beef in a vacuumed plastic pouch/bag and submerging this in a heated water bath for 500 minutes until the internal core temperature of the joint was between 55-60C. After this the joint is then unwrapped and placed in a hot skillet to sear the joint. The Yorkshire puddings are then cooked in a hot oven (2kWh).

4. **Reduced portion size of beef**: Halve the size of the portion of beef (125g). All other assumptions remain the same.

5. **10% energy efficiency increase of oven**: increase energy use efficiency by 10%, this would equate to a reduction to 1.8kWh energy usage oven. All other assumptions remain the same.

6. **Organic ingredients**: use the embodied energy use values for organic production found in the Williams, Audsley and Sandars 2006 report [43]. All other assumptions remain the same.

7. **Sous vide cooking method with organic ingredients**: use the assumptions from scenarios 2 and 5.

8. **Sous vide cooking method with organic ingredients and reduced portion size of beef**: use the assumptions from scenarios 2, 3 and 5.
Why scenario 2 (low heat)

- 19.5 min
- 3.5 hrs
Why scenario 4 (half beef portion)

Current portion of beef 250g

Eat well guide recommends max 70g of meat a day.

Reduction to 125g still leaves leftovers!

Minimum weight found in sample was 120g
Results

Energy used for ingredients and for cooking (MJ) in the traditional “hot oven” method (a) Williams, Audsley and Sandars (2006) and b) May, Adams, and Plackett (2013)) with median timings, and in the 8 scenarios.
Thoughts…

• Scenario 7: a 53% energy reduction overall (36MJ from 77MJ)
• Hard to implement, UK households reluctant to
  1) reduce the beef portion size,
  2) switch to organic foods (cost or ingredient accessibility
  3) adopt a method of cookery using a modern, unfamiliar, and inaccessible, piece of cooking
     equipment. (However, this method is widespread in restaurants?)

But this is just one meal, not a diet!

Values could be lower if better quality energy use and LCA data was available.
We need to better understand the role of eating out of the home in demand shifting.
We need to change …

- What we eat (animal protein)
- How much we eat? (leftovers?)
- How we cook our food.
- How we power our homes.
Thank you!

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[@sartorialfoodie](https://twitter.com/sartorialfoodie)
# Additional data

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Typical steps in recipe

- Pre heat oven **20 minutes**
- Roast beef (2kg) in oven for **75 minutes**
- Make batter. (combined Egg (200 g), Flour (225g), Milk (347ml), Water (118ml), and Oil (30ml))
- Oil/dripping (57ml) in Yorkshire Puddings pan to heat **5 minutes**
- Cook Yorkshire Puddings **20 minutes**