

# RESEARCH INSIGHT

## WHAT MAKES PEAK ELECTRICITY DEMAND?

### INSIGHTS FROM TIME USE ANALYSIS

#### Key points

- There is a lot of variation in what people do during the evening period of peak electricity demand.
- Women generally have a more fragmented set of activities at peak time than men, age differences can also be significant.
- Interventions focused on shifting demand out of the peak need to take into account how patterns of time use vary across the population.
- The make-up of peak demand is influenced by areas of policy other than energy, such as those which affect the labour market.



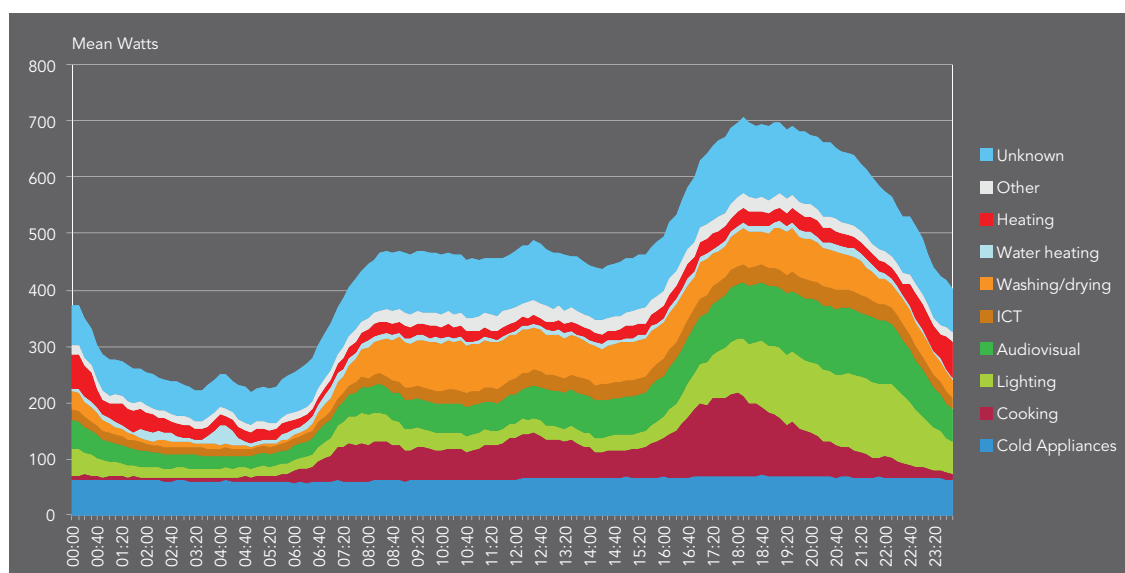
The aim of our research was to develop a more differentiated understanding of household peak electricity demand by analyzing data on peoples' time use (from the UK 2005 Time Use Survey and a smaller survey conducted by Trajectory Ltd in 2011). We demonstrate the value of this form of analysis including its implications for attempts to move domestic energy use out of peak periods.

#### Introduction

Peaks in energy demand are problematic for the electricity system as they increase costs and carbon emissions. Peaks typically occur early in the morning and most strongly in the early evening and are generally expected to become more pronounced and problematic in the future. Detailed monitoring of domestic electricity consumption is beginning to provide some insight into the types of demand that feature across different parts of the day (see Fig. 1). However such data is limited in scope and cannot provide a differentiated view of how electricity demand relates to patterns in what people are doing during peak periods and how this varies. An alternative approach is to use time use data.

#### Questions

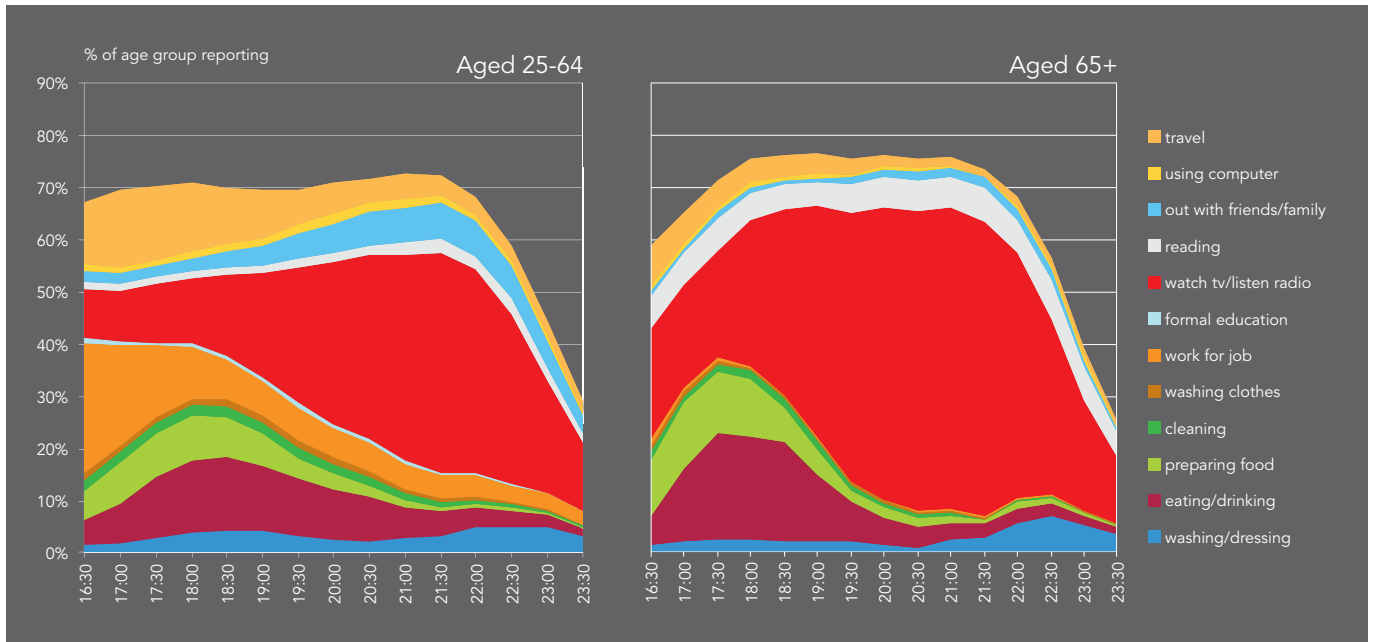
- What are people doing during the evening peak period?
- How much variation is there in what people do during periods of peak energy demand, by day of week, age and gender?
- What do these patterns imply for flexibility and for the potential to shift activities out of the peak period?



**Figure 1** Average 24 hour electricity use profile for sample of 250 owner occupied homes. 2010-11 (data source DECC 2013)

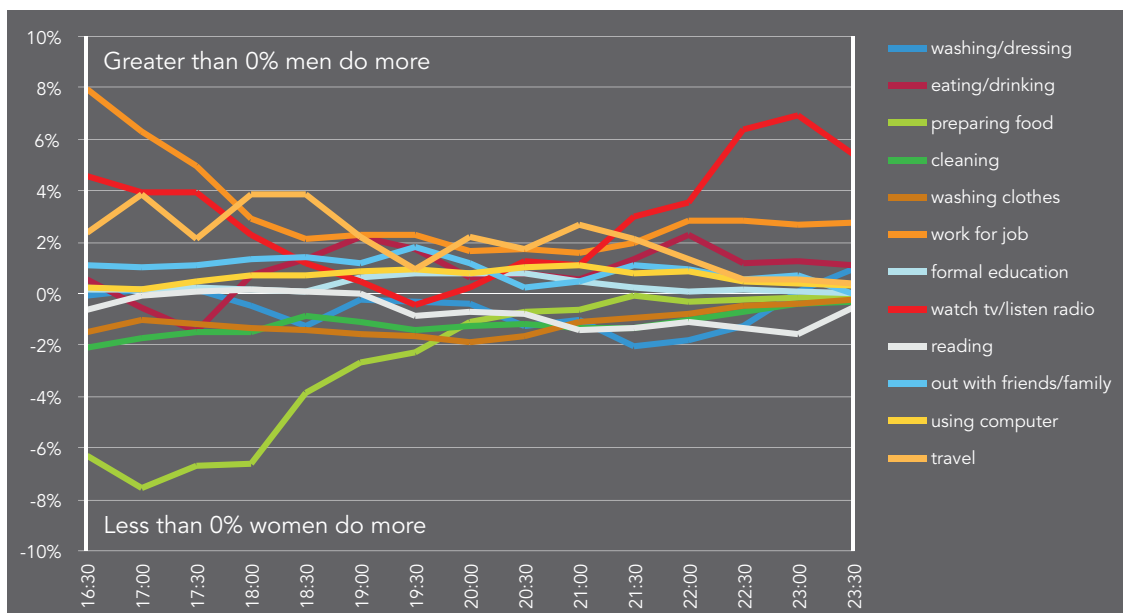
## Findings

- There is a lot of variation in what people do during the evening peak period.
- Peak time activities differ across the days of the week. For example, there is more eating and drinking in peak hours on Mondays compared to Fridays, but less personal care and washing. This is because more socialising takes place outside of the home on Fridays.



**Figure 2** Weekday activities during the evening for 25-64 vs 65+ (UK, 2005)

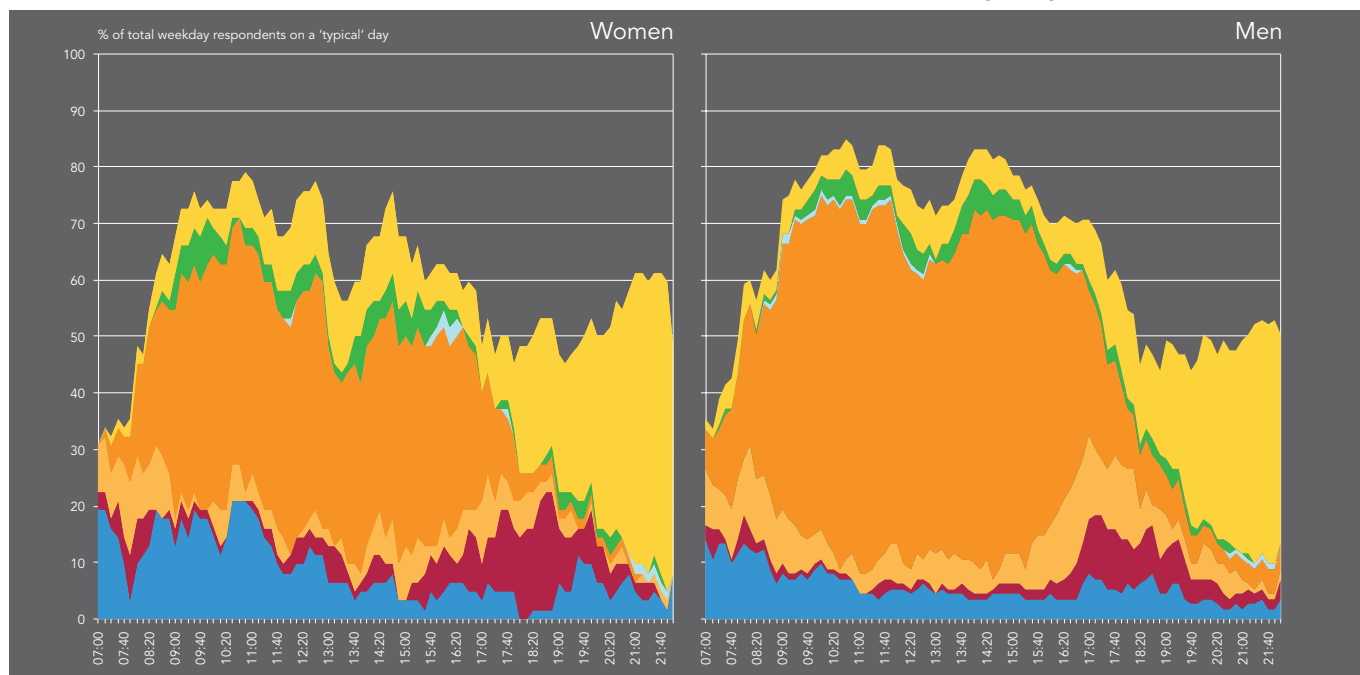
- There are significant differences between people in different age groups. As an example, Fig. 2 shows that the nature of the evening weekday peak is markedly different for those aged 16-64, where work (and potentially family commitments) has an impact on subsequent evening activities, compared to those aged 65+.
- There are also significant differences between what men and women do during the evening peak. Fig. 3 shows that the higher labour market participation of men and the continuing domestic labour responsibilities of women produce distinctly different profiles in the earlier part of the evening. A greater proportion of women are spending time preparing food from 16.30 through to 19.00 when more men are still at work. A later evening shift towards media consumption by men can also be seen.



**Figure 3** % difference between men and women's time use during the evening (UK, 2005). Greater than 0% = men do more. Less than 0% women do more

**Figure 4** Weekday time use patterns by gender for 18-64 age group and for the highest % activity categories (Trajectory 2011)

- Audio-visual entertainment, using internet, phones, mobiles etc.
- Shopping
- Formal education and healthcare
- Working
- Travelling
- Food and drink preparation, cooking and washing up
- Washing, cleaning and maintenance in the home



- Women generally have a more fragmented set of activities at peak time than men. Fig. 4 reveals these patterns by focusing not only on peak periods, but on the whole day. Women's activity patterns are more spikey, indicating that activities are carried out for shorter periods of time. Women are in paid employment for a shorter period of the day than men and more of them experience a break from paid employment at lunch time. Their travelling is also less continuous and more scattered throughout the day. As a result, men's use of time is more synchronised during the working day, and less synchronised in the evenings compared to women.

### Significance

This research is intended to stimulate new thinking about what makes peak energy demand, and about how this differs and varies within society. Our analysis shows that interventions designed to shift demand out of the peak need to take account of the following features:

- Peaks are made of different activities depending on the day of the week.
- Particular energy using activities show significantly different temporal patterns by gender – the timing of housework, paid employment and watching TV in the evening are clear examples.
- Age differences in time use are significant and relate to differences in the structuring effect of work or family

commitments. This may be particularly important given the progressively aging profile of the population.

- It is useful to think of peak demand as an outcome of the simultaneous doing of energy-using activities. Patterns of societal synchronization underlie peak electricity demand.
- From a policy perspective our research shows that the make-up of peak demand is influenced by areas of policy other than energy. This is clear in the effects of labour market participation and working hours on the nature and timing of evening activities. A higher degree of variation in working hours might, for example, diffuse evening peak electricity demand, although it may not reduce demand overall.
- From a network operator perspective the results suggest that geographical areas that are more homogeneous – in terms of household characteristics – may be prone to more significant local peaks. Where there is more local 'synchronization' in what people are doing there may be stronger peaks in electricity demand.
- From a research perspective any large scale household energy demand model which seeks to represent overall demand under different scenarios needs to take account of the timing of people's activities. Our research shows that time use data can be used for this purpose.

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