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Laundry, Energy and Time: Insights from 20 Years of Time-Use Diary Data in the United Kingdom

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Abstract

The uneven temporal distribution of domestic energy demand is a well-known phenomenon that is increasingly troublesome for energy infrastructures and sustainable or low carbon energy systems. People tend to demand energy, and especially electricity, at specific times of the day and they do not necessarily do so when the sun is shining or the wind is blowing. The potential value of demand response as a solution rests on understanding the nature of temporal energy demand and the timing of the interconnected domestic activities that drive it. The paper uses current and historical time-use diary data to explore the temporal change in laundry practices in the United Kingdom over the last 20 years. 'Doing the laundry' is frequently cited as a potentially 'flexible demand' and yet very little is known about when people do the laundry, who does it at particular times, how this has changed and what implications this might have for the flexibility of demand. Through this analysis of laundry, the paper starts to unpack some of the 'doings' that contribute to current known energy demand and considers the extent to which they may or may not enable flexibility in the context of consumer demand response.

Highlights

- Effective demand response requires analysis of the timing of electricity demand
- Historical time use survey data reveals evolving demand & traces of flexibility
- Increase in Sunday morning & early weekday morning laundry, decrease in weekday daytime laundry
- Increased women in work force & other social constraints may drive laundry timing
- Energy demands continually evolve through societal transformation

Keywords

Demand response, laundry, electricity demand, timing, time use, social practices

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Contents

1 Introduction

Whilst there is considerable focus on the reduction of overall energy demand in the context of climate change in the United Kingdom (DECC, 2013), increasing attention is also being given to understanding the drivers of electricity demand at particular times of day (Torriti, 2015). This is largely driven by the need to ameliorate the effects of regular demand peaks of increasing magnitude on an ageing local distribution infrastructure (Strbac, 2008; Darby and McKenna, 2012; Strengers, 2012); to reduce reliance on 'high-carbon high-cost' fuel sources during demand peaks (Torriti et al., 2010) and to attempt to better match demand to localised, time-specific or intermittent low-carbon generation (Barton et al., 2013; Peacock and Owens, 2013).

One proposed solution is to incentivise consumers not only to reduce demand but also to shift the timing of their electricity demand through Demand Response (DR). This is conceived as a socio-technical infrastructure (Strbac, 2008; Darby and McKenna, 2012) enabling flexible and adjustable pricing mechanisms as well as other forms of demand manipulation through a combination of domestic smart meters (McKenna et al., 2012) and a communications infrastructure integrating control of generation, supply and demand in a 'smart gird' (Giordano and Fulli, 2012). Whilst investigation of the technologies (Giordano et al., 2013) scenarios (Xenias et al., 2014) and consumer acceptability (Balta-Ozkan et al., 2013a; Geelen et al., 2013; Naus et al., 2014) of a range of smart grid concepts is ongoing very little is known about what people actually do that generates demand for electricity at specific times of day (Walker, 2014; Torriti, 2014).

Clearly the variance and flexibility of the temporal distribution of electricity demand is of fundamental importance to the ability to shift the scale and timing of consumption in order to balance load on the network and adapt to intermittent or temporally inflexible (non-dispatchable) generation (Darby and McKenna, 2012; Barton et al., 2013). This is particularly so where the timing of (un)intentionally synchronised household activities play a significant role in creating peak demand periods (Walker, 2014). Currently the dominant mode of incentivising the demand shifting is through differential pricing but, given the generally moderate to low price elasticity of residential electricity consumption (Reiss and White, 2005; Fouquet, 2011; Fan and Hyndman, 2011), it seems clear that alternative approaches based on the re-configuration of consumers' electricity-demanding activities might be an additional tool as Australian work has shown (Strengers, 2011, 2012).

Whether the levers are to be price manipulation or habit reconfiguration, it is clear that understanding what different people do at different times of day and how that generates demand for electricity is a predicate for understanding the practical value of demand response approaches across the domestic customer population (Widén et al., 2012, 2009). There is also a strong argument that understanding how such demand has evolved over time will give a substantially more nuanced view of how it has come to be embedded in current ways of 'doing' everyday life (Shove and Walker, 2014; Walker, 2014). This in turn may highlight the uneven distribution of energy demand across gendered domestic labour roles as work in the UK and Sweden has shown (Murtagh et al., 2014; Palm and Ellegård, 2011) and may also give some insight into how current patterns of activities may or may not be open to change as work in both Australia (Nicholls and Strengers, 2015) and the UK (Powells et al., 2014) demonstrates. Finally, such analyses would also explore how wider social transitions in norms and everyday practices (Southerton, 2009) as well as more specific studies of particular practices such as eating (Cheng et al., 2007; Southerton et al., 2012; Warde et al., 2007), heating (Gram-Hanssen, 2011; Shove, 2003) and laundry (Shove, 2003; Wilhite and Shove, 2003) have consequences for the timing and extent of energy demand.

The overall objective of this paper is therefore to use historical time diary data to explore the evolution of the temporal variation of 'doing the laundry' as an exemplar of a particular energy-demanding activity over the last 20 years in the UK. Although limited to a single country, the literature would suggest that the processes underlying the changes described may be found in other countries with similar social, material and normative arrangements (Treas and Drobnič, 2010). As will be discussed, this is particularly the case for countries where the increasing labour market participation of women is associated with a reduction in time available for historically gendered routine domestic work (Kan et al., 2011; Van der Lippe et al., 2010).

This twenty-year timeframe demonstrates the value of time use diary data in analysing the cross-sectional temporal variation of these practices and in revealing aspects of their evolution through time. In so doing the paper contributes to emerging research themes at the intersection of energy and social science such as the need to explore novel methods to scale up 'human centered' research methods (A. L. Browne et al., 2014; Sovacool, 2014), to report analyses of representative population samples over time (Sovacool, 2014), to understand the evolution of energy use 'conventions' (Sovacool, 2014) and especially the dynamics of the gendered distribution of energy consumption, (Sovacool, 2014). In addition, the paper explores the value of identifying the distribution of portfolios of laundry practices across different kinds of people, as a stepping-stone towards what might be termed a 'practice-based' domestic energy consumption analysis.

2 Energy, Practices and Time

Whilst the academic and policy literatures contain an increasing number of studies of current energy consumption patterns through household metering and appliance monitoring (Firth et al., 2008; Richardson et al., 2010; Wright and Firth, 2007; Yohanis et al., 2008; Zimmerman et al., 2012), there has been little attempt to consider the interconnections between these patterns and the activities that underpin them. Thus rather than seeking to link activities through appliances (or lighting & heating systems) to consumption, the nature of the activities that generate the observed consumption is essentially ignored (Shove and Walker, 2014).

There are however a few exceptions that have attempted to take account of aspects of the timing and nature of specific activities more directly, generally using time-diary data as the basis for modeling energy demand (Ellegård and Palm, 2011; Widén et al., 2012, 2009; Wilke et al., 2013; Torriti, 2014). Here, energy demand patterns are ascribed to the range of activities recorded using a variety of average/appliance use approaches and recent work (Durand-Daubin, 2013) has highlighted the extent to which this approach may or may not be valid for different appliances in different contexts in France. As Palm and Ellegard's work shows, not only can such data provide empirically grounded models of demand but it can also reveal the variation in temporal demand that derives from differences in the sequences of activities people report. In doing so they highlight the potential to cluster consumers not by the usual socio-demographic characteristics but by the activities in which they engage (Ellegård and Palm, 2011, p. 177) potentially providing a focus point for specific interventions.

Recent studies using historical time-use surveys have revealed trends in the distributions of gendered domestic labour across a range of European countries and provide some hint of the consequences for energy demand patterns (Kan et al., 2011; Moreno-Colom, 2015). This is

also true of more specific studies focusing on the relationship between domestic work and household technologies (Bittman et al., 2004; Cowan, 1983) and also studies of particular practices such as eating (Cheng et al., 2007; Southerton et al., 2012; Warde et al., 2007), heating (Gram-Hanssen, 2011; Shove, 2003) and laundry (Shove, 2003; Wilhite and Shove, 2003).

Nevertheless there has been little analysis of the evolution of the timing of patterns of domestic energy demand. This is unfortunate as considering such variation offers a critical tool for identifying loci of potential intervention, change (Pullinger et al., 2014) and routine re-configuration of the kind envisaged by Strengers. Of course foregoing or shifting demand presumes that activities can be straightforwardly 'shifted' in the domestic context. As yet very little is known about the kinds of consumers for whom this may currently be true (Powells et al., 2014; Walker, 2014). The extent to which other social transformations may alter this proclivity in the future is also unclear although recent studies have highlighted the potential non-shiftable nature of tightly integrated family evening practices in Australia (Nicholls and Strengers, 2015).

This paper's approach to this challenge draws on the argument that understanding temporal energy demand depends on understanding the timing, location, context, materiality and performance of a range of inter-connected social practices (Shove and Walker, 2014; Walker, 2014). To understand how these connected practices might change in the future we need to understand how they came to be. As Higginson et al (2013) emphasise, to assume that practices are inviolable is to claim that they never change and that reductions in energy demand can therefore only be attained through increasing efficiency of the material components of a 'fixed' practice. Yet there is substantial empirical evidence that all social practices evolve, albeit at differing rates and with different trajectories (Shove, 2003; Cheng et al., 2007; Shove et al., 2012). In addition, consumers are able to adapt to disruptions to practices (Trentmann, 2009), especially if those disruptions are short-lived (Higginson et al., 2013; Strengers, 2012). If practices have changed then they are in principle *changeable* irrespective of the anticipated levers. Understanding these trajectories of change is therefore crucial to understanding the barriers to and potential practical value of demand response approaches.

In response to these challenges, this paper uses historical time diary data to link the relatively sparse existing body of work on the timing of laundry to an analysis of the temporal 'footprints' of laundry practices through their traces in UK national time use surveys from 1985 to 2005. According to recent research 'washing and drying' constitutes around 14% of overall household electricity demand placing it roughly equivalent to lighting, cooking and audio-visual appliances in the absence of electric space heating (Zimmerman et al., 2012, p. 28). Reducing this general level of demand is one focus of ongoing efforts to increase appliance efficiency, to promote lower temperature washes, 'proper' load volumes and 'correct' detergents in Germany (Kruschwitz et al., 2014). Other work has identified different drying practices in southern European countries compared to those in northern Europe where seasonal and weather factors reduce the opportunity for line-drying (Schmitz and Stamminger, 2014). However laundry has also evoked interest as being a relatively synchronised (Shove, 2003) but 'flexible' (Higginson et al., 2013; Powells et al., 2014) and 'shareable' (Wallenborn and Wilhite, 2014) element of energy demand which may be amenable to active or automation-based time-shifting (Darby and McKenna, 2012; Balta-Ozkan et al., 2013b). Qualitative studies of interactions with in home displays giving feedback on energy consumed have suggested that some forms of laundry may be difficult to shift (Murtagh et al., 2014) and that other laundry may already be done outside peak demand

periods (Nicholls and Strengers, 2015). On the other hand it has also been reported that such tools can prompt more reflective 'planning' of laundry practices (Hargreaves and Burgess, 2010) and responses to the availability of the households' own microgenerated electricity (Butler et al., 2014).

An analysis of exactly when laundry is currently done and by whom would therefore lead towards some understanding not only of the value of shifting laundry from a DR perspective but also of the potential constraints to flexibility. By looking at multi-decade change in the timing and sequencing of laundry, light may also be shed on how the current patterns came to be, on the current social contexts in which they are embedded and how they may evolve in the future.

3 The timing of Laundry

Laundry's continually evolving material arrangements and performances (home vs laundry service, machine vs hand wash, cold vs hot wash; line dry vs tumble etc (Watson, 2014)) have clear implications for temporal demands for energy (Shove, 2003). So too does its sequential processes (wash, dry, air/iron) with varying temporal arrangements. In addition, as in other climates with highly variable weather, such as the UK, there are substantial weather and seasonal contingencies (Zimmerman et al., 2012). To further complicate, changing notions of 'dirt' and 'freshening up' (Pink, 2005) combine with evolving norms of cleanliness (Shove, 2003) and, in turn, interact with clothing types and purposes to produce additional priorities (Browne et al., 2013a; Higginson et al., 2013; Jack, 2013). The effects of perceptions of appliance use (noise, 'flood/fire risk', smell (Butler et al., 2013)) and the need to 'keep on top of the washing' (Shove, 2003) merely add to the complexity of when to launder. Further, the relationship between the volume of clothes owned (Shove, 2003), need for re-use, machine capacities and perceptions of what (Pink, 2005) and when to launder what suggests that there may be no simple relationship between household characteristics, laundry frequency and appliance efficiency (see (Slob and Verbeek, 2006; Jack, 2013) but also (Kruschwitz et al., 2014; Laitala et al., 2012) for evidence of the role of household size and age).

Historical work has charted the changing nature of women's domestic work (Zmroczek, 1992; Jackson, 1992) and the role of 'labour saving technologies' such as the automatic washing machine (Cowan, 1983). This has also been addressed in the time use literature (Bianchi et al., 2000, 2012; Bittman et al., 2004; Kan et al., 2011) which has shown that although male contributions to domestic work have increased, especially where a female partner is in work, this effect is not substantial for 'routine' chores such as laundry (Moreno-Colom, 2015). Similar analyses have also emerged in the energy demand literature where studies of the nature of household energy-demanding activities have demonstrated the need to focus on the potential consequences of shifting domestic energy demand for women in particular (Carlsson-Kanyama and Lindén, 2007; Murtagh et al., 2014). As a result an analysis of laundry practices would expect to reveal a range of patterns of performance of laundry and for them to be enacted in the context of a range of constraining contingencies and commitments but to still be highly gendered (Kan et al., 2011).

The paucity of good quality and accessible data on the nature of laundry as a household activity has been noted in comparative work on the consequential levels of electricity and water consumption (Pakula and Stamminger, 2010). Recent work by Laitala et al (2012) recorded changes to Norwegian laundering practices of sorting clothes, programme choice and detergent dosage between 2002 and 2011. However, whilst appliance penetration rates and technical attributes are also relatively well-known, precise usage characteristics such as

the volume of clothes per cycle, or the variation in load frequency are poorly documented for most countries (Laitala et al., 2012). More importantly for the purposes of this paper, the temporal nature of laundry and its associated drying is largely unknown (Firth et al., 2008).

Overall then, it is clear that there has been rather little consideration given to how the contexts and practices of laundry manifest in temporal energy-demand patterns and especially not to how this temporality might be changing. The objective of the remainder of this paper is to provide just such an analysis.

4 Methods

Time use data, in the form of temporal activity diaries generally administered as part of a household or individual survey and covering all activities throughout (ideally) a given week, has been a niche instrument in quantitative social science research since the early 20th century (Harvey, 1993). Historical time-use survey data therefore provides traces of the sequencing, synchronisation, timing and location of a range of social practices over time. Foundational research in the 1960s brought together a plethora of diary-like studies especially from the UK, France, Canada, the USA and Russia/USSR (Converse and Szalai, 1972) and this has been continued by the Multinational Time Use Study (Gershuny et al., 2012) to produce a dataset which includes both socioeconomic variables (see Table 5 in the Technical Annex) and a set of 69 'harmonised' activity codes (see Table 7) for 5, 10, 15 or 30 minute time slots across eleven countries from 1965 to 2009.

As will be demonstrated in this paper, comparative analysis over time must take into account changes in coding schemes, data collection methods, sampling and response details (Anable et al., 2014). Nevertheless as Table 1 indicates for the UK components of the MTUS, the ability to construct a history of the timing, sequencing and, in some surveys, the location of activities provides a basis for analysis of changing practices over time. Whilst it would have been preferable to analyse change over the longest possible period, the harmonised MTUS category of "MTUS 21: Laundry" in 1974 is a re-coding of the 1974 category "50: Other essential domestic work". This excluded the 1974 code "54: Routine housework" which was harmonised as "MTUS 20: Cleaning" only. Since it seems likely that 'doing the laundry' may well have been classified as 'routine housework' by respondents in 1974 this paper excludes data for 1974 on the basis that the coding of laundry may be extremely unreliable.

Table 1: The MTUS[1] (World 6) UK sub-samples and definitions of 'laundry' over time

Survey	Sample	Sample size (individuals) and months collected	Time interval	Format	'Laundry'		
					Original source code	MTUS Definition	Notes
1974	All 5+ in representative household sample	2,598 February, March, August, September	30 minutes	7 diary days, primary & secondary activities (73 codes), location known, co-presence unknown	50 Other essential domestic work	21: Laundry, ironing, clothing repair	i.e. NOT 'routine housework' (defined as cleaning); NOT 'Prepare meals or snacks'
1983	Representative sample 14+	1,350 January, February, September, November, December	15 minutes	7 diary days, primary & secondary activities (188 codes), location known, co-presence of others known	0701 Wash clothes, hang out / bring in washing; 0702 Iron clothes; 0801 Repair, upkeep of clothes	21: Laundry, ironing, clothing repair	Note bundled clothing related activities.
1987	Representative sample 14+	1,586 March - June	15 minutes	7 diary days, primary & secondary activities (190 codes), location known, co-presence of others known	701 wash clothes & hang out to dry; 702 ironing; 801 repair and upkeep of clothes	21: Laundry, ironing, clothing repair	Note bundled clothing related activities.
1995	Representative sample 16+	1,962 May	15 minutes	1 diary day, primary activities only (31 codes), location & co-presence of others unknown	14 Clothes	21: Laundry, ironing, clothing repair	Considerable lack of clarity of what activities this includes.
2000	All 8+ in representative household sample	8,688 All months	10 minutes	7 diary days (weekday & weekend), primary & secondary activities (265 codes), location known, co-presence of others known	3300 Unspecified making and care for textiles; 3310 Laundry; 3320 Ironing; 3390 Other specified making and care for textiles	21: Laundry, ironing, clothing repair	Note bundled clothing related activities.
2005	Representative sample 16+	4,854 March, June, September, November	10 minutes	1 diary day, primary & secondary activities (30 codes), location known, co-presence of others unknown	P/sact=7 (washing clothes)	21: Laundry, ironing, clothing repair	Drying, ironing and airing but may exclude other clothing related activities such as repair.

[1] Available from http://www.timeuse.org/mtus/

As a result the analysis reported here is restricted to the UK surveys for 1983/7 and 2005 given the deplorable current lack of a more recent UK national time-use survey (but see Fisher and Gershuny (2013)).

To further complicate, the 1983 survey was a mainly autumn/winter sample whilst 1987 was a spring/summer sample (Table 1). Thus to enable valid comparison with the 12 month (all season) 2005 survey, this paper followed the MTUS guidance (Gershuny et al., 2012) and pooled the 1983 and 1987 samples to form a '1985' sample comparable with 2005.

The `1985' and 2005 UK time use surveys were both collected from representative random samples of the population. The '1985' sample constitutes a household survey where one resident aged 14+ per household was asked to complete a self-administered diary for the hours 04:00 – 04:00 on each day of a selected week. Respondents were asked to list the 'most important' activities they were engaged in during each 15 minute period. The responses were then fitted to some 190 activity codes for primary and secondary activities and location (Table 6) and co-presence with others was also recorded.

In contrast the 2005 study recruited individuals aged 16+ for one day only but with a sampling frame ensuring that representative coverage of all days of the week was achieved. The diary used a pre-coded instrument that captured primary and secondary activities in 10 minute periods of the day. Given this approach, we would expect the 2005 diary to underestimate the incidence of less-than-daily events (Gershuny, 2012; Sonnenberg et al., 2012) and especially for events that may regularly occur on days other than the randomly selected diary day, as might be the case for laundry. The survey asked whether respondents were at home or elsewhere and this has been used by the MTUS team to infer a slightly more fine-grained location coding using associated activities (Table 6).

As noted above this paper focuses on code '21' for "laundry, ironing, clothing repair". Code '21' is an imperfect proxy for actually 'doing the laundry' as other related activities may be included depending on the survey coding, the respondent's interpretation of the pre-codes in the case of the 2005 survey. There is also the potential for socially desirable response effects (Podsakoff et al., 2012) which may lead to under or over-reporting of laundry by different groups.

A further complication (see Table 1) is that the '1985' data was collected in 15 minute periods whilst the 2005 data was collected in ten minute periods making direct comparison of rates and durations of activities across surveys problematic. An aggregation approach was therefore used to count the number of recorded laundry episodes in each half hour and derive an indicator of any laundry being reported as a primary activity in a given half hour. The rate of recording of secondary acts overall was much higher (30% of episodes) in 1985 than 2005 (16%). This was especially true for laundry which was recorded as a secondary act in 15% of all episodes of laundry in 1985 but only 6% in 2005. The reasons for these differences are unclear but may include the design of the diary instrument, the diligence of the respondents, the coding harmonisation process and, potentially, the changing nature of the act. As a result of these uncertainties, laundry recorded as a secondary act was not included in the derived 'at least once in the half hour' indicator.

Finally all MTUS cases originally coded as 'bad cases' due to concerns over diary quality were removed leaving a file of 910,896 half hour records for 1985 and 227,904 for 2005.

5 Results

Initial analysis of the weighted aggregated half hour data at the individual diary day level (Table 2) showed that "laundry, ironing, clothing repair" ('laundry') was recorded as a main

activity at least once in 1.37% (95% CI: 1.32% - 1.41%) of half hours in 1985 and in 1.01% (0.94% - 1.08%) of half hours in 2005. The table also confirms the ongoing unequal gender distribution of laundry in the UK with 92% of recorded laundry half-hours being reported by women in 1985 and a somewhat lower 84% in 2005.

Analysis of location suggested that 98% of reported laundry was undertaken 'at own home' in 1985 (87% in 2005), under 0.5% at 'services/shops' such as launderettes and 0.3% at 'other locations'. Although it was not possible to distinguish between different non-home locations in the 2005 data and 10% of reported laundry had an unknown location so that the values do not sum to 100%, there is some evidence that out of own home laundry had become more prevalent at 3.5% compared to 1.46% in 1985.

These results suggest that less laundry was being done in 2005 than in 1985, or that it was taking less time, or that less was being reported – or any combination of these. However, given that that the definitions of laundry were different in each of the survey, as was the method of measurement, the apparent differences in rates of reporting may not be strictly comparable. To avoid this problem and to focus on the analysis of the temporal distribution of reported laundry within and between years, the remainder of the paper assumes that reporting error or bias due to different coding interpretations or social desirability is randomly distributed, and thus ignorable, within particular surveys. With this assumption, the *relative* distribution of recorded laundry within years can then be analysed and these relative in-year distributions compared across years.

Table 2: Descriptive statistics for 'any laundry' indicator in half hours (MTUS UK sub-sample, weighted)

		N half hours	% of half hours			% of reported laundry half hours	Reported by women (% of all laundry half hours reported)		
			%	% CI (lower)	% CI (upper)	%	%	% CI (lower)	% CI (upper)
1985	All half hours	960607							
	Any laundry	13123	1.37%	1.32%	1.41%		91.94%	90.95%	92.93%
	Any laundry 'at home'	12932	1.35%			98.54%			
	Any laundry 'at another person's home'	88	0.01%			0.67%			
	Any laundry 'at shop/services'	52	0.01%			0.40%			
	Any laundry 'other locations'	41	0.00%			0.31%			
2005	All half hours	229378							
	Any laundry	2316	1.01%	0.94%	1.08%		83.81%	80.24%	86.92%
	Any laundry 'at home'	2004	0.87%			86.56%			
	Any laundry 'at another person's home'	Cannot be determined							
	Any laundry 'at shop/services'	Cannot be determined							
	Any laundry 'other locations'	80	0.03%			3.46%			
	Any laundry 'location unknown'	231	0.10%			9.98%			

5.1 Laundry days

Noting the caution regarding comparison of absolute measures, Figure 1 shows the distribution of laundry half-hours recorded in a given year across days of the week. Although the 95% confidence intervals tend to overlap due to the relatively small sample size in 2005, there is some evidence of a re-distribution of laundry away from most weekdays and towards Fridays and Sundays. This partly confirms the results from Browne et al's large scale survey of laundry practices in the South East of England (2013b) which showed that the most frequently cited timing of laundry was 'at the weekend' (29% of respondents).

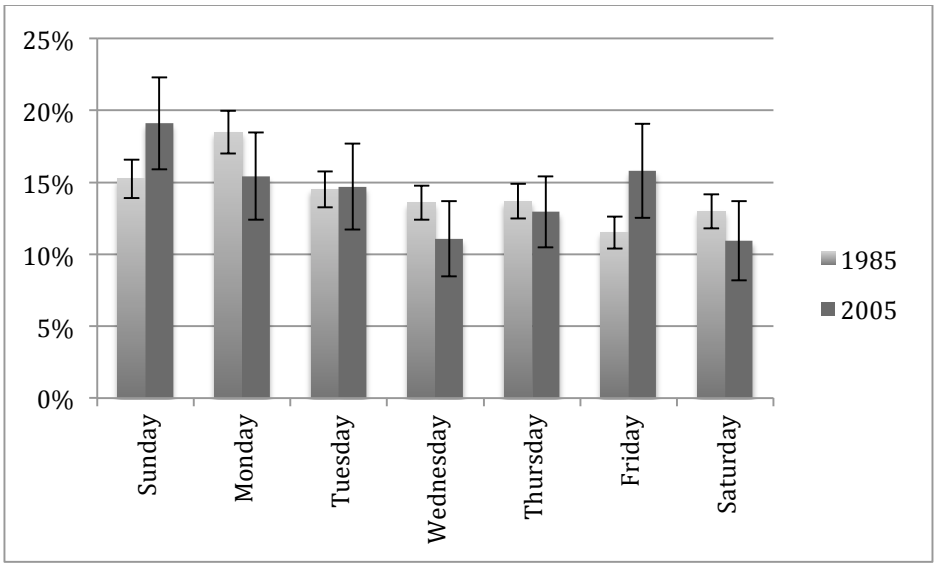

Figure 1: Distribution of laundry as a primary activity by day of the week (MTUS UK sub-sample, weighted, indicator = any laundry in a half hour, value = % of recorded laundry carried out in that year, confidence intervals = +/- 95%)

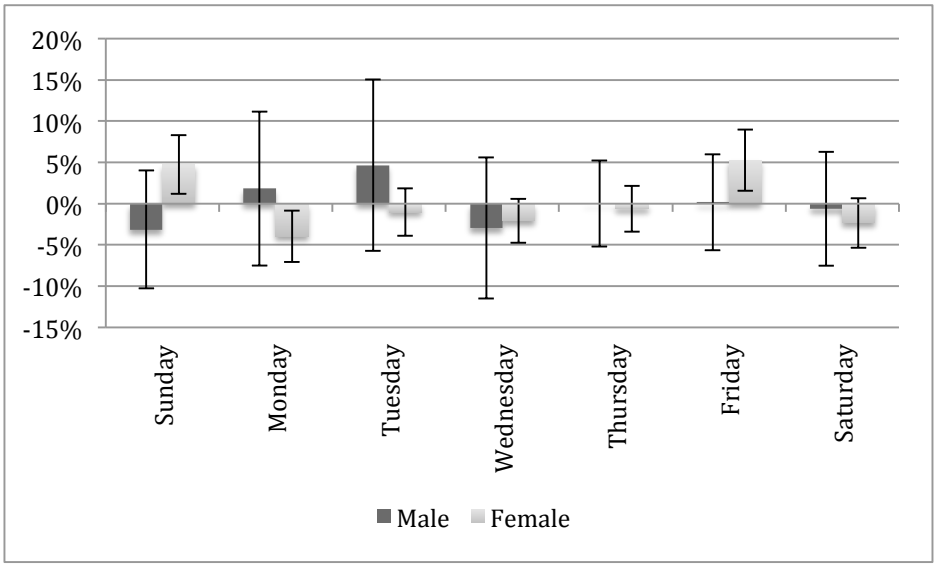

Figure 2: Percentage point increase/decrease in reported laundry by day of the week for men and women from 1985 to 2005 (MTUS UK sub-sample, weighted, indicator = any laundry in a half hour, confidence intervals = +/- 95% for 1985 proportion)

This re-distribution is confirmed by Figure 2 which shows the percentage point change in the relative (within-year) distribution of laundry for men and women. The large error bars for men are to be expected given their very low level of laundry reporting and the chart suggests that the shift from Monday to Sunday and Friday laundry may be largely driven by changes in women's laundry practices. Women report a 5 percentage point increase in the relative distribution of laundry on Sundays (an increase of 32%) and a similar value for Fridays (a 45% increase) between 1985 and 2005.

In 1985 25% of full-time working women reported laundry on Sundays compared to 19% for Saturdays and 11-12% on weekdays. In contrast 21% of those not in work reported laundry on Mondays and 16% on Tuesdays. Perhaps unexpectedly the proportion of laundry reported by full-time working women on Sundays did not change between 1985 and 2005 but there was a noticeable 4-6 percentage point increase in the reporting of Sunday laundry for those in part time work or not in paid work at all. This was matched by a similar decrease in the reporting of laundry on all weekdays (especially Mondays) for all groups with the exception of an increase of up to 6 percentage points for all employment groups on Fridays.

Overall, the timing of laundry as a whole appears to have evolved from 1985 to 2005 with a particular trend towards a lower proportion being carried out on Saturdays and during the week (especially on Mondays) and a higher proportion of laundry being carried out on Fridays and on Sundays.

5.2 Laundry times

Whilst the changing distribution of laundry across the week offers insights into the evolving nature of laundry overall it is the nature of its timing within the day which is likely to be of greater concern in the DR context. Figure 3 shows the twenty-four hour profiles for reported laundry in 1985 and 2005 as a percentage of all half hours. It is immediately noticeable that, as before, the data suggest that less laundry was being done in 2005 than was the case in 1985, especially through the middle of the day. However there was an increase in early morning reported laundry (before 08:30) but little change to equally low rates of late night (after 22:00) laundry related activities confirming Browne et al's finding that only 3% of households in the South East of England timed their laundry to make use of cheap over-night electricity (Browne et al., 2013a).

If robust given the potential measurement problems outlined above, these changes reflect an increase in demand for electricity in the early morning and a substantial decrease in demand during mid- morning.

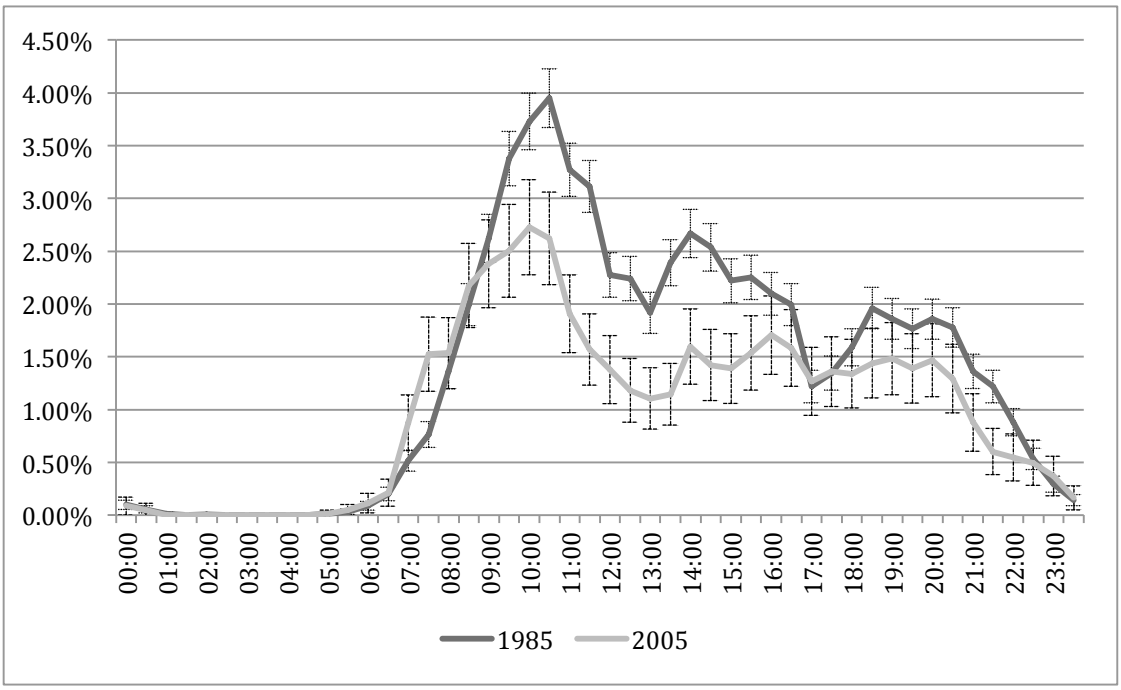

Figure 3: Distribution of % of half-hours reported as laundry by time of day for each year (MTUS UK sub-sample weighted, error bars are 95% confidence intervals)

In order to more clearly reveal the components of these differences, Figure 4 shows the percentage point difference between the 1985 and 2005 relative reported laundry rates for each half hour of the day by day of the week. For clarity the relative rate is the temporal distribution of all laundry reported in a particular half hour within a given year as a proportion of all laundry half-hours reported. Saturdays and Sundays are shown as distinct days but weekdays are represented by the mean values across all five weekdays at each half hour of the day.

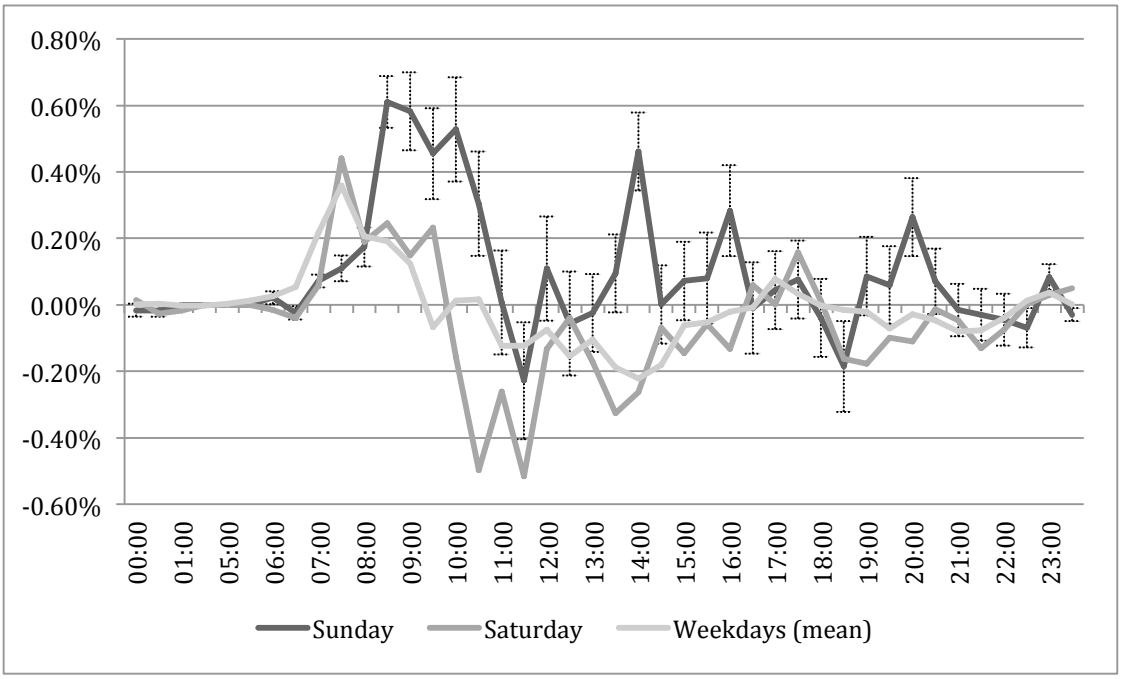

Figure 4: % point change in timing of reported laundry by weekday vs weekend and by time of day for each year (MTUS UK sub-sample weighted, for clarity, only 95% confidence intervals for Sunday included).

These results show that far more of the reported laundry was in the early morning (06:00 – 09:00) on both weekdays and Saturdays in 2005 than was the case in 1985. Indeed the increase in early morning laundry for weekdays is predominantly early on Monday and Friday mornings (not shown) and, in the case of the latter, constitutes most of the change shown in Figure 2. This shift appears to have occurred alongside a reduction in weekday daytime, and especially later morning laundry on Saturdays. However the most obvious changes are focused on Sunday with an increase in morning (08:00 – 11:00), early afternoon and also early evening (20:00) laundry which may, given the definition of the time use activities, also include ironing or other clothes related preparation for the week ahead.

5.3 Laundry types

The preceding analysis combined with the discussion of peak electricity demand suggests that there may be a number of emerging variants in the performance of laundry in the that are of particular interest in the demand response context and could form the basis for a 'practice-based' categorisation.

The first is weekday early morning laundry (06:00 – 09:00) where power demand may contribute to an emerging early morning peak demand period; weekday morning laundry (09:00-12:00) where power demands, especially towards the end of this period, might correspond to surplus network capacity from renewable sources; evening laundry (17:00 – 20:00) where demand sits squarely within the increasingly problematic evening peak demand period and Sunday morning laundry (08:00 – 11:00) whose demands on the distribution network may be unproblematic but which may indicate a group of emerging significance given its apparent increase in prevalence. A focus on variation in the performance of practices explicitly recognizes that a given launderer may have a repertoire. Since it is the different performances that generate differently timed energy demand, this implies that we should focus attention on particular performances, such as evening weekday laundry which coincides with peak electricity demand, rather than on particular kinds of people (Shove and Walker, 2014).

Table 3: Prevalence of types of reported laundry in 1985 and 2005 (MTUS UK sub-sample, weighted, % = percentage of half hours in which any laundry was recorded)

	1985			2005			Change	
	%	95% CI (lower)	95% CI (upper)	%	95% CI (lower)	95% CI (upper)	% point change 1985 to 2005	% change 1985 - 2005
Early weekday morning	6.2	5.7	6.7	11.5	9.7	13.3	5.3	85.0
Weekday morning	21.5	20.6	22.6	20.7	17.8	23.5	-0.8	-3.7
Weekday evening	12.1	11.2	12.9	11.2	9.2	13.1	-0.9	-7.7
Sunday morning	4.4	3.8	4.9	6.0	4.4	7.6	1.6	37.8
Other	55.9	54.6	57.2	50.7	47.3	54.1	-5.2	-9.3

Table 3 shows the relative prevalence of these types of laundry as a percentage of laundry half-hours reported in each year. Overall these temporally defined laundry types accounted for just under 50% of all laundry half-hours in each year. There was a substantial increase in the proportion of early morning weekday laundry (5.3 percentage points or 85%) whilst

Sunday morning laundry had a lower growth rate (1.6 percentage points or 38%), albeit with less certainty. In contrast the prevalence of both weekday morning and weekday evening laundry fell by between 4 and 8% as we might expect from Figure 4.

In 1985 49% of launders reported just one practice but 10% reported more than one with the highest rate of multiple performances being for those in part-time work. In contrast in 2005 54% of launderers (57% for launderers in full time work) reported just one laundry type but 9% reported more than one with the highest rate of multiple performances (10%) being for those not in paid work. However, since the 2005 single day diary cannot capture both weekend and weekday laundry practices for the same person, the degree of within-individual variation in the performance of laundry in 2005 is likely to be underestimated.

These patterns were analysed further using a set of logistic models (Table 4) designed to identify factors associated with different types of laundry in 2005. Informed by the preceding descriptive analysis and by literature on time spent on domestic labour of the sixteen countries covered by the MTUS[2] (Kan et al., 2011; Van der Lippe et al., 2010) and the fifteen covered by HETUS[3] (Moreno-Colom, 2015), these models test the extent to which work status, age and the presence of children play a role in predicting the performance of a particular laundry type.

The results suggest that early weekday morning laundry (reported by 20% of launderers in 2005) is more likely to be reported by launderers aged 45+ with the strongest effect being for those aged 75+ (OR = 2.4). Analysis of subsequent episodes indicates the most likely next activity to be cleaning (22% of subsequent episodes) and food preparation (12%) with travel to work at only 7% corroborating the lack of an effect for work status.

Weekday morning laundry on the other hand (24% of launderers) is much less likely to be reported by launderers in part-time (OR = -0.7) or, especially, full-time paid work (OR = -1.6).

Weekday evening peak laundry (16% of launderers) was more likely to be reported only by launderers in full-time paid work (OR = 0.8) although there is some evidence that it is also more likely to be reported by launderers with 2 or 3+ children but the estimates are marginally non-significant at the 95% level. Analysis of episodes before and after this form of laundry suggest that it is embedded in evening family activities (Nicholls and Strengers, 2015) with the most frequent preceding activity being meals or snacks (32% of episodes) and food preparation (12%) and afterwards being watching TV (25%) and food preparation (16%).

The model for Sunday morning laundry (7% of launderers) shows no statistically significant effects although there is some evidence of a positive association with having more children. Perhaps contrary to expectations, Sunday morning laundry is not therefore predicted by labour market status. Rather, the slightly more problematic practice of evening peak laundry is associated with being in full time work confirming the results of recent UK and Australian qualitative studies (Higginson et al., 2013; Nicholls and Strengers, 2015).

[2] MTUS: Canada, UK, USA, Australia, France, Netherlands, Germany, Austria, Slovenia, Denmark, Norway, Finland, Sweden, Italy, Spain and Israel

[3] Harmonised European Time Use Survey (HETUS): Italy, Spain, Estonia, Latvia, Lithuania, Poland, Bulgaria, Slovenia, UK, France, Germany, Belgium, Finland, Norway and Sweden.

Table 4: Logistic estimation results for factors predicting performance of a given laundry type in 2005 (MTUS, UK sub-sample, respondent level analysis)

	Sunday morning 09:00-11:00				Weekday early morning 06:00 - 09:00				Weekday morning 09:00-12:00				Weekday evening peak 18:00-21:00			
	OR	CI (lower)	CI (upper)	Sig.	OR	CI (lower)	CI (upper)	Sig.	OR	CI (lower)	CI (upper)	Sig.	OR	CI (lower)	CI (upper)	Sig.
Intercept	-3.524	-6.452	-1.854	***	-3.403	-6.300	-1.810	***	-0.635	-1.697	0.295		-1.920	-3.004	-0.981	***
Part-time (not in work)	-0.097	-0.798	0.585		-0.065	-0.562	0.424		-0.713	-1.188	-0.254	**	0.385	-0.142	0.911	
Full time	-0.249	-1.002	0.484		0.097	-0.394	0.588		-1.559	-2.143	-1.011	***	0.807	0.286	1.341	**
25-34 (< 25)	0.786	-0.948	3.723		1.630	-0.016	4.542		-0.089	-1.102	1.034		-0.165	-1.131	0.921	
35-44	0.876	-0.806	3.798		1.932	0.321	4.833	.	-0.215	-1.204	0.893		-0.268	-1.212	0.803	
45-54	1.193	-0.524	4.127		2.195	0.583	5.097	*	0.325	-0.654	1.427		-0.550	-1.543	0.554	
55-64	1.191	-0.550	4.139		2.221	0.603	5.126	*	0.124	-0.851	1.222		0.072	-0.903	1.173	
65-74	0.913	-0.970	3.907		1.985	0.304	4.909	.	0.353	-0.657	1.477		-0.344	-1.509	0.887	
75+	1.192	-0.634	4.170		2.385	0.725	5.304	*	0.259	-0.747	1.380		-0.527	-1.723	0.725	
1 child (no children)	0.102	-0.885	1.019		0.161	-0.441	0.749		-0.547	-1.246	0.113		0.243	-0.389	0.858	
2 children	0.616	-0.319	1.547		0.066	-0.596	0.712		-0.324	-1.046	0.375		0.632	-0.005	1.268	.
3+ children	0.785	-0.379	1.902		-0.345	-1.358	0.561		-0.649	-1.595	0.229		0.413	-0.490	1.263	
N	866				866				866				866			
Null deviance	486.51				883				973.44				760			
Residual deviance	480.85				866.2				885.93				733.33			
AIC	504.85				890.2				1658.7				757.33			
Durbin Watson	1.916				1.877				1.934				1.825			

Table notes:

OR = Odds ratio

N: Respondents who reported laundry only

Gender excluded as a co-variate due to its dominance as a predictor of reporting any laundry

Contrast categories in parentheses

. = $p < 0.1$, * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.005$ (note that conclusions drawn from p values and confidence intervals may differ for marginal results)

6 Discussion

Although there are clear limitations to the data, the results reported above provide a number of insights based on a novel analysis of the changing temporal patterns of laundering in the UK.

Overall, using the 'any in a half hour indicator' laundry (and associated activities) were reported substantially less frequently in 2005 than 1985 although the different data collection methods and instruments used in each year mean that comparison of absolute measures is difficult. However, the relative temporal distribution of reported laundry appears to follow roughly the same profile in 2005 as it did in 1985 albeit with some notable shifts. These shifts have tended to concentrate the majority of laundry reported in 2005 into periods such as early weekday mornings, Sunday mornings and, although at a reduced level compared to 1985, more traditional weekday mornings. Thus, with the exception of some evening laundry (or ironing etc. c.f. Table 1) generally reported by those in paid work, most laundry was reported as being done outside the peak electricity demand periods of weekday evenings.

However the increase in early morning weekday laundry may contribute to increased electricity demand at this time of day. Given that the time-use diary may report a range of activities related to 'doing the laundry' (e.g. sorting clothes, loading machine) it is possible that some of these activities are carried out earlier in the day and the machine actually washes the clothes at a subsequent time (Durand-Daubin, 2013). Although this activity is likely to involve the use of an automated and/or time-set washing machine, it may also be associated with the increased use of tumble driers which were to be found in 58% of households (71% where at least two adults were in work) in 2005 (Office for National Statistics and Department for Environment, Food and Rural Affairs, 2007). In both instances, this may signal an impending potential early morning peak demand problem although the sequence analysis suggests that most early morning launderers are still at home some time after laundry is reported and may therefore be able to line dry rather than automatically tumble dry clothes.

In contrast there is little evidence of a similar 'setting laundry going' activity at the end of the day confirming Brown et al's result that less than 5% of survey respondents report doing the washing at a time that uses cheap overnight electricity. This suggests that the nature of laundry may preclude night-time use for the reasons highlighted earlier and which, in turn, means that laundry is unlikely to be switchable to cheaper low demand overnight periods. However, the increased prevalence of early morning laundry does imply that there may be potential to incentivise laundering to match intermittent (or mid-day) low carbon generation (Butler et al., 2014) or day-time periods of low demand. Clearly, as others have argued (Schmitz and Stamminger, 2014), much more needs to be known about the time, timing and energy use of drying clothes.

As might be expected from more general sociological analyses of routine domestic work (Kan et al., 2011; Moreno-Colom, 2015), the strongly gendered nature of laundry is largely unchanged and this immediately raises questions for current approaches to the development and conceptualization of domestic demand response strategies (Strengers, 2013, 2014). Given that women are, mostly, still the launderers and also increasingly active in the labour market, the results reinforce the argument that increased attention needs to be given to the routines, habits, constraints and motivations of female consumers (Carlsson-Kanyama and Lindén, 2007; Murtagh et al., 2014). This is particularly the case if Hargreaves et al's finding that in-home displays providing energy use feedback in the UK are generally attended to by the male

partner in couples (Hargreaves and Burgess, 2010) is more widely replicated. As Hargreaves et al note, demand response strategies and technologies need to help to foster 'cooperative and energy-saving household dynamics' (Hargreaves and Burgess, 2010, p. 6118) rather than unintentionally setting 'rational economic' financial considerations on a collision course with the strongly gendered practicalities of doing what needs to be done (Murtagh et al., 2014). In this light, the increased reporting of early weekday and Sunday morning laundry is hardly surprising given the increase in full-time female labour market participation over the 1985 – 2005 period although the regression estimation results suggest that Sunday morning laundry was practiced more widely in 2005 than just by those in paid work.

Analysis of different temporal performances of laundry revealed that individuals have a repertoire of laundry practices (Table 3:). The four temporal types identified accounted for just under half of all laundry half-hours in 1985 and 2005 and the most notable increases were in early morning weekday and Sunday morning laundry. Weekday evening peak laundry comprised 14% of laundry half hours suggesting that addressing their laundry habits may prove of benefit in the demand response context although recent work suggests that this may be difficult to achieve (Nicholls and Strengers, 2015).

At least 9% of launderers exhibited more than one of the four temporal types in 2005 suggesting that targeting performances of practices rather than their performers per se may be more constructive. A preliminary attempt to assess the factors associated with these variants (Table 4) suggested clear relationships between employment status and weekday morning/weekday evening laundry although it was noticeable that there were few statistically significant effects and the models had relatively low explanatory power.

This in turn indicates the lack of clear relationships between standard socio-demographics characteristics of households and the details of, in this case, their laundry habits. As has been found in other contexts (A. L. Browne et al., 2014; Medd and Shove, 2007), apparently similar households often display substantially different performances of practices and may also display a repertoire of practices. There is therefore no such thing as a weekday evening launderer – weekday evening laundry may be more likely to feature in the repertoire of certain kinds of people, but that is a rather different conclusion.

7 Conclusions and Implications

Overall these results suggest that for some, laundry has shifted away from its traditional mid-week morning performance towards early weekday and Sunday mornings with the most substantial change in the relative timing of laundry being an increase in reported laundry on Sunday mornings for women. Whilst there is little overt attention being given to direct policy-based manipulation of domestic practices in the UK (see for example (DECC, 2014)), the results have implications both for the political objective of reducing carbon-based energy demand and also for commercial infrastructure investment decision-making.

The analysis highlights the role of wider societal change in transforming the everyday constraints that structure the timing of energy-using practices in general and laundry in particular. These include changes to (female) labour market participation that may be pushing laundry energy demand into the more problematic weekday morning and evening peak periods and also the less problematic Sunday mornings. We might also hypothesise that early evening laundry, with its consequential role in exacerbating high-cost and high-carbon peak electricity demand (Torriti, 2015) may be driven by just-in-time laundry (or ironing) for work/school (Sundays) and for going out (Fridays) in line with the findings of recent studies in the UK and elsewhere (A. Browne et al., 2014; Jack, 2013). If this is indeed 'laundry', then it

may be dependent on the availability of tumble driers, as might an increase in early morning laundry by those in work. Similar studies to those recently conducted in France Durand-Daubin (2013) that link time-use and appliance usage data will be needed to more clearly understand the relationships between different forms of laundry and their precise temporal energy demand.

Shifts in energy use may already be occurring for reasons that have little to do with demand response (or price tariffs) but are adaptations to other changing contingencies and circumstances such as trends in the time women spend on domestic and paid work. Analysis of the countries covered by the MTUS (Kan et al., 2011; Van der Lippe et al., 2010) and HETUS (Moreno-Colom, 2015) suggests that the UK is similar in this regard to most other European nations which show an overall reduction in time spent on routine domestic work (cooking, cleaning, laundry) by women. The Nordic countries have experienced the greatest reductions and also the greatest gender equalisation of routine domestic work whislt the Netherlands and France the least (Kan et al., 2011). This in turn implies that consideration of the wider system of everyday practices, including paid work, would be needed if we wish to properly assess options to 'reduce and shift' laundry in much of Europe. These include the nature and stocks of clothing, the 'efficiency' of different laundry methods, the timing of 'clothed activities' and the 'need' for clean clothing (Browne et al., 2014; Shove et al., 2012). If these complexities are true of laundry then they are also undoubtedly true of other social practices that might be targets for demand response and similar empirical analyses will be required.

Further the results suggest that flexibility and 'shiftability' are difficult concepts in the context of laundry and demand response. Given that 33% of launderers did not report any of the types of laundry identified, there remains significant variation in when laundry is done and it may be that the still strongly gendered nature of routine domestic work in the MTUS countries, together with observed shifts in labour market participation and caring responsibilities (Kan et al., 2011; Van der Lippe et al., 2010) may be forcing laundry even further into the 'whenever I have the time' performance highlighted by Browne et al (2013b). As others have noted in the Australian context, there may in fact be much less flexibility and ability to shift than was historically the case (Nicholls and Strengers, 2015).

In terms of future directions for this work, there is clearly scope for exploration of lifestage or inter-generational differences using age and cohort analyses to derive insights of use in laying out possible demand response futures as current launderers age. There is also scope to extend the 'laundry types' analysis to explore the factors underlying the various performances of laundry in 1985 as a means to analyse the evolution of the epidemiology of the practices over time. An important aspect of this analysis would be to tease out the implications of increased service sector work, with its less structured or more fragmented work schedules (Kan et al., 2011) on the temporal organisation of routine domestic labour activities. More widely these analyses could be repeated using the other countries represented in the MTUS data to provide comparative insights across different climates, cultures and labour market policy and institutional contexts (Kan et al., 2011; Treas and Drobnič, 2010; Van der Lippe et al., 2010).

The data offers the potential to examine seasonal, regional and national differences that may interact with regional weather conditions alongside material arrangements for drying the washing although the relatively small sample sizes involved may mean sub-group analysis are not statistically robust.

The data also offers scope to expand our understanding of how the place of laundry in the sequence of household activities is changing. This may provide further indications not only of the range of different performances of laundry but also the potential consequences of

disruption to these sequences through changes in habits or as a result of specific interventions (Carmichael et al., 2014; Powells et al., 2014).

However there are also a number of shortcomings that, although unlikely to be addressed in future general purpose time-use surveys, may be addressed in bespoke studies of the practices that generate energy demand. These include the need to conduct analyses over periods of time relevant to the phenomena of interest. For example, the 1 day UK diary collected in 2005 was ill equipped to assess the within-person variation in laundry practices and made it difficult to robustly compare the range of practices with the more appropriate week-long 1985 diary. As noted above, closer coupling of time-use and appliance usage data is vital but so is a finer categorization of energy consuming activities to enable distinctions between sorting washing, drying and ironing clothes to be made. It would also be important to collect data on the activities of all household members to better understand the range of laundry performances enacted within a household, rather than from the perspective of just one launderer. This would also enable better matching of appliance use to reported behavioural data in a multi-occupancy household. Further, such studies would need to distinguish between the different material arrangements used so that models of electricity demand can more accurately estimate the energy demand implications of different performances of 'washing' and 'drying' for example (McKenna and Thomson, 2016; Widén and Wäckelgård, 2010). Similarly it may also be important to distinguish between energy-using practices done as part of paid service work and those done as unpaid domestic work since any interventions designed to shape these variants would almost certainly differ.

In summary this work provides an example of the kind of analysis that is required to assess the changing nature of routine energy-using practices as a basis for assessing the practical value of demand response strategies. With respect to laundry, signs of flexibility can be detected in the evolving nature of its temporal organisation, whilst the influence of constraining factors on those dynamics has been revealed by the analysis of gender and employment status differences. These add further evidence for the need to consider the gendered nature of domestic activities in the development and implementation of 'smart grid' socio-technical systems. Above all the analysis should remind us that current patterns of demand are not 'given' but are simply a slice through a constantly evolving system - even for something as mundane as laundry.

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10 Technical Annex

10.1 MTUS core socio-economic variables, location indicators and time use codes

Note that not all of the core socio-economic variables and time-use codes can be derived for every survey.

Table 5: MTUS core socio-economic variables (Gershuny et al., 2012)

Variable	Content	Variable	Content
countrya	Country or region of survey	sex	Sex
survey	Year survey began (survey id)	age	Age
swave	Longitudinal study wave marker	famstat	Individual level family status
msamp	Multiple samples in study	cphome	Unmarried child in parental home
hldid	Household identifier	singpar	Single parent
persid	Person/diarist identifier	relrefp	Relation to Household ref person
id	Diary identifier	civstat	In a couple
parntid1	Person id 1st parent of diarist	cohab	Cohabiting
parntid2	Person id 2nd parent of diarist	citizen	Citizen/national of country
partid	Person id of spouse or partner	empstat	Employment status (full time/part time/unknown)
day	Day of week diary kept	emp	In paid work
month	Month diary kept	unemp	Unemployed
year	Year diary kept	student	Student status
diary	Diary order	retired	Retirement status
badcase	Marker of low quality cases	empsp	Employment status of spouse/partner
hhtype	Household type (family status: single, couple, couple with children, mixed sharing)	workhrs	Hours paid work last week including overtime
hhldsize	N people in household	empinclm	Original monthly labour income
nchild	N children aged<18 in household	occup	Occupation
agekidx	Grouped age of youngest child in household (includes adult children)	sector	Sector of employment
agekid2	Actual age youngest child in household	educa	Education-original study codes
incorig	Original household income	edcat	Harmonised highest level of education
income	Total household income grouped	rushed	Whether diarist usually feels rushed
ownhome	Tenure: Owns, rents	health	Diarist's general health
urban	Urban or rural household	carer	Provides adult care
computer	Household has computer/internet access	disab	Has disability/long-term health condition
vehicle	Number of private vehicles usable by household		

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Table 6: MTUS (World 6) UK sample activity location codes for the '1985' and 2005 surveys (Gershuny et al., 2012)

Survey	Location	Notes
'1985'	Own home	
	Another's home	Relative, friend or other private home
	Workplace	Normal or other workplace, including other associated workplace
	School	Schools, colleges and learning-related buildings
	Services or shops	Includes direct personal services, hairdresser, salon and laundrette
	Restaurant, café	
	Place of worship	
	Travelling	
	Other locations	All other cases
2005	Own home	
	Another's home	Not possible to distinguish
	Workplace	Inferred where non-home work was recorded
	School	Inferred where non-home education was recorded
	Service or shop	Inferred where shopping was recorded so laundrette use is not detectable
	Restaurant, café	Inferred
	Place of worship	Not possible to distinguish
	Travelling	
	Other locations	All other cases

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Table 7: MTUS harmonised time use codes (Gershuny et al., 2012)

MAIN/SEC 69	Activity	MAIN/SEC 69	Activity
Main/Sec1	Imputed personal and household care	Main/Sec36	Attend sporting event
Main/Sec2	Sleep or nap	Main/Sec37	Cinema, theatre, opera, concert
Main/Sec3	Imputed sleep	Main/Sec38	Other public event, venue
Main/Sec4	Wash/dress/care for self	Main/Sec39	Restaurant, café, bar, pub
Main/Sec5	Meals at work or school	Main/Sec40	Party, reception, social event, gambling
Main/Sec6	Other meals	Main/Sec41	Imputed time away from home
Main/Sec7	Paid work, main job (not at home)	Main/Sec42	General sport or exercise
Main/Sec8	Paid work at home	Main/Sec43	Walking
Main/Sec9	Second or other job not at home	Main/Sec44	Cycling
Main/Sec10	Unpaid work to generate household income	Main/Sec45	Other out-of-doors recreation
Main/Sec11	Travel as a part of work	Main/Sec46	Garden, forage (pick mushrooms), hunt/fish
Main/Sec12	Work breaks	Main/Sec47	Walk dogs
Main/Sec13	Other time at workplace	Main/Sec48	Receive or visit friends
Main/Sec14	Look for work	Main/Sec49	Conversation (in person, phone)
Main/Sec15	Regular schooling, education	Main/Sec50	Other in-home social, games
Main/Sec16	Homework	Main/Sec51	General indoor leisure
Main/Sec17	Leisure/other education of training	Main/Sec52	Artistic or musical act
Main/Sec18	Food preparation/ cooking	Main/Sec53	Written correspondence
Main/Sec19	Set table, wash or put away dishes	Main/Sec54	Knit, crafts, hobbies
Main/Sec20	Cleaning	Main/Sec55	Relax, think, do nothing
Main/Sec21	Laundry, ironing, clothing repair	Main/Sec56	Read
Main/Sec22	Home/vehicle maintenance or improvement	Main/Sec57	Listen to music, Ipod, CD
Main/Sec23	Other domestic work	Main/Sec58	Listen to radio
Main/Sec24	Purchase goods and general consumption activities	Main/Sec59	Watch TV, DVD, video
Main/Sec25	Consume personal services	Main/Sec60	Play computer games
Main/Sec26	Consume other services	Main/Sec61	Send e-mail, surf internet, computing
Main/Sec27	Pet care (not walk dog)	Main/Sec62	No activity but recorded mode of travel
Main/Sec28	Physical, medical child care	Main/Sec63	Travel to or from work
Main/Sec29	Teach, help with homework	Main/Sec64	Education-related travel
Main/Sec30	Read to, talk or play with child	Main/Sec65	Voluntary, civic, religious travel
Main/Sec31	Supervise, accompany, other child care	Main/Sec66	Child & adult care travel
Main/Sec32	Adult care	Main/Sec67	Shopping, personal & household care travel
Main/Sec33	Voluntary, civic, organisational activity	Main/Sec68	Other travel
Main/Sec34	Worship and religion	Main/Sec69	No recorded activity
Main/Sec35	General out-of-home leisure		