



Increasing the flexibility of electricity consumption in private households: Does gender matter?



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ABSTRACT

Increased reliance on renewable electricity production is important for reducing greenhouse gas emissions. Inducing households to adjust the timing of their electricity consumption to fit fluctuations in renewable electricity supply can help make this possible. In a field study, 71 Danish households received incentivized text messages, suggesting that they shift electricity consumption to certain hours of the day. The study shows that when text messages were sent to women, there was a significantly greater response than when they were sent to men. Based on qualitative in-depth interviews, we find that an important reason for this is gender difference in household work task responsibility. Our study suggests that incorporating knowledge about gendered practices when designing and targeting policies to change electricity consumption habits and induce flexibility could significantly increase their effectiveness.

1. Introduction

Expanding renewable electricity production is an important part of the greening strategy of many countries (Committee on Climate Change, 2015; The Danish Government, 2011; The Government of Norway, 2012; The Government of Sweden, 2008). However, the availability of renewable wind and solar energy can change dramatically during the day, resulting in increased supply volatility (Chu and Majumdar, 2012; Karki and Billinton, 2001). In other words, the supply of renewable electricity is determined 'as the wind blows'. One way of addressing this is to induce greater flexibility in electricity consumption. According to the Danish Energy Commission, the Danish Energy Association and the state-owned company that owns the Danish electricity and gas transmission system, flexible electricity consumption will become an important element of a well-functioning future intelligent energy system (Altinget, 2016; Danish Energy Association and Energinet.dk, 2013). This also seems to be the expectation of the EU (European Commission, 2011).

In the EU, private households account for 30% of total electricity consumption (European Environment Agency, 2015). Similarly, in Denmark, private households account for 31% of total energy consumption (Danish Energy Agency, 2016). Hence, developing flexible electricity consumption within private households has great potential. To date, promoting flexible electricity consumption within private

households has mainly been through technological fixes and economic incentives, but these approaches have been criticized for downplaying the cultural dimensions of energy use (D'Agostino et al., 2011; Kempton and Layne, 1994; Lutzenhiser, 1992; Lutzenhiser and Shove, 1999; Sovacool et al., 2012; Wilhite et al., 2000). In order to fully understand flexible electricity consumption, we need to understand, on a very practical level, what different people do within private households and how this generates electricity demand (Anderson, 2016; Aune, 2007; Skjølsvold et al., 2016; Walker, 2014; Widén et al., 2009).

Much of what people do within households is culturally determined according to gender (Munro and Madigan, 2006).¹ In fact, the household is one of the most gendered spheres of society in most cultures. Despite many years of gender equality work, there is a significant gender division within the modern family home in western countries (ibid.). Household chores, such as cooking and doing the laundry, are predominantly performed by women (Carlsson-Kanyama and Lindén, 2007; Ellegård and Palm, 2011; Laermans and Meulders, 2006; Shove, 2003), and women usually spend much more time performing household chores than men (Bianchi et al., 2000; Carlsson-Kanyama and Lindén, 2007; Sayer, 2010). Because flexible electricity consumption requires changing the timing of daily electricity-consuming household chores to different times of the day, gender is likely to have an important mediating effect on how households respond to flexible electricity consumption programs.

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¹ In section 2, we explain how we perceive the concept of gender in this paper.

Several studies have found that gender-specific practices are important for electricity consumption. Ellegård and Palm (2015, 2011) find that men and women carry out different activities in the home and, hence, consume energy in different ways. Clancy and Roehr (2003) point out that women often take on the responsibility for reducing electricity use connected with household electric appliances. In line with this, Carlsson-Kanyama and Lindén (2007) find that it is mainly women who respond to increases in peak hour electricity tariffs because they perform tasks such as washing clothes and dishes, which can be shifted to low peak hours. Women also avoid using tumble dryers, which results in more time being spent on this task. Jensen et al. (2012) find that single women are less likely to install auto-power-off devices, which reduce standby electricity consumption, than single men and couples. They suggest this might be due to gender differences in the skills and/or interest in installing the technology and willingness to spend time and effort on installation. Tjørring (2016) shows that the different practices of men and women in the house influence the negotiation and decision-making process for doing energy renovations. Because men and women do different things in the shared household, they prefer to invest in different forms of renovation that affect their particular practices (ibid.).

Generally, women influence and are influenced by energy issues in different ways to men, whether it be due to differences in the way men's and women's everyday lives are influenced by energy conservation (Carlsson-Kanyama and Lindén, 2007), unequal representation of women and men in the energy sector (Carlsson-Kanyama et al., 2010; Clancy and Roehr, 2003; Ryan, 2014), differences in the use of energy (Ellegård and Palm, 2015, 2011; Isaksson and Ellegård, 2015; Rätty and Carlsson-Kanyama, 2010; Tjørring, 2016), or differences in environmental concern (Clancy and Roehr, 2003; Dietz et al., 2002; Zelezny et al., 2000). Knowledge about these gender differences can be used to develop targeted, more energy-efficient energy supply and demand.

In this paper, we investigate the effect gender has on private households' participation in a Danish experimental flexible electricity consumption program. More precisely, through two questionnaires and twenty in-depth interviews with participants in the experimental flexible electricity consumption program, we investigate how the potentially gendered everyday energy consuming activities within the household affect the adoption of flexible electricity consumption.

In the following, we start by explaining the social cultural model for understanding gender-specific differences in the work tasks related to the flexible electricity consumption of households. This is followed by an outline of the field study of a flexible electricity consumption program and the research method, which is based on a combination of questionnaires and qualitative in-depth interviews with the private households participating in the field study. Next, we present the results of the questionnaires and qualitative interviews and, finally, discuss the implications of gender differences for practice and policy.

2. Theoretical perspectives: Social and cultural perspective on gender

In this paper, the roles of men and women are seen as being socially constructed rather than biologically determined. The concept of gender is in line with West and Zimmerman's (1987) social constructivist perspective (West and Zimmerman, 1987). Furthermore, in this paper, gender is investigated in the context of a family consisting of a couple with or without children. These categories are based on the power company SE's use of Statistics Denmark's definitions.² This opens up for recognizing the interaction between people who live together, which is likely to be affected by gender. As Ellsworth-Krebs et al. (2015) point out, there is a tendency to overlook the interaction *between* householders in the context of energy consumption. Household members

have different preferences and practices, and they have different positions in the household hierarchy (Ellsworth-Krebs et al., 2015). This is not to say that single households are not affected by cultural gender norms, or that they are not relevant to examine in the context of increasing the flexibility of energy consumption. It is merely an expression of our choice of an in-depth focus on gender and the interaction between people within the household. Focusing on households that consist of at least two people is not meant to be representative of all households. Rather, it is an explorative study to investigate the importance of gender when addressing energy consumption in private households.

As West and Zimmerman (1987) point out, gender roles are created through human interactions. In this paper, we have chosen to focus on the connection between gender and activities in the house in a very concrete manner because energy consumption is closely connected to what people do in the house. People's daily practices essentially demand electricity in private households (Shove, 2003; Strengers, 2012). Using electricity in private households (and elsewhere) is only a medium for performing tasks such as the laundry, cooking, dish-washing, etc. When we turn on a lamp, it is not because we want to use electricity, but rather because we want light and we want to do something with the light. Therefore, in order to understand electricity consumption, we need to understand the practices surrounding using light, doing the laundry, cooking, etc. In this paper, we focus on how gender is connected to these energy-consuming household practices. We use the term, practice, which is understood as people's daily household activities such as cooking, doing the laundry, drying clothes, etc. The concept of practice is used as a descriptive term, rather than an analytical term with theoretical and abstract implications (see Pink, 2012:16).

3. The field study

In a field study, the potential for increasing flexible electricity consumption through monetary and pro-social incentives was investigated.³ Fig. 1 shows the average daily electricity consumption in 2011 of the 247,010 private households in the study area supplied by the power company SE. The intervention involved giving households incentives to sometimes shift their power consumption to a time during the period 20:00 and 23:00 and sometimes to a time outside these hours (period between dotted lines). The power use profile indicates that many households use a lot of power-intensive appliances just prior to the period, but that use decreases during the period 20:00–23:00. Hence, there is potential to even out the peak by shifting electricity consumption to the period between 20:00 and 23:00. However, the households were also sometimes encouraged to shift their electricity consumption away from these hours. The reason for this was to simulate a situation in which the electricity consumption is adjusted to the production of wind energy. In this situation, electricity production alternates between there being too much and too little. The intervention period was static, i.e. it was always between 20:00 and 23:00. Another Danish research project on flexible electricity consumption had found that more households adopted flexible electricity consumption with static-time of use prices rather than real-time-prices (Friis and Haunstrup Christensen, 2016). Finally, the period between 20:00 and 23:00 was chosen based on the assumption that most households are at home during this period and, hence, have the opportunity to change their electricity consumption.

A sample of 4042 households was randomly selected from SE's customer data base⁴ and invited to join what was called the MovePower

³ The field study was organized by a partnership between the energy company, SE, the University of Copenhagen, the Danish Technical University and the private company, Develco Products.

⁴ SE has a database of their 247,010 customers. Of the 247,010 customers, 40,490 have given SE contact permission. 4042 households were randomly selected and invited out of

² There is some uncertainty as to how SE has implemented the definitions.

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