



Competition and norms: A self-defeating combination?



Genevieve Alberts^a, Zeynep Gurguc^{b,*}, Pantelis Koutroumpis^b, Ralf Martin^b,
Mirabelle Muûls^{b,c}, Tamaryn Napp^c

^a Energy Futures Lab, Imperial College London, South Kensington Campus, London SW7 2AZ, United Kingdom

^b Imperial College Business School, Imperial College London, South Kensington Campus, London SW7 2AZ, United Kingdom

^c Grantham Institute - Climate Change and the Environment, Imperial College London, South Kensington Campus, London SW7 2AZ, United Kingdom

HIGHLIGHTS

- We investigate the effect of information feedback on residential energy consumption.
- A RCT tests whether norms affect the decisions of price-indifferent participants.
- Feedback mechanisms and norms reduce energy consumption by 22% on average.
- Introducing prize competition dissipates the impact of information feedback and norms.

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ABSTRACT

This paper investigates the effects of information feedback mechanisms on electricity and heating usage at a student hall of residence in London. In a randomised control trial, we formulate different treatments such as feedback information and norms, as well as prize competition among subjects. We show that information and norms lead to a sharp – more than 20% - reduction in overall energy consumption. Because participants do not pay for their energy consumption this response cannot be driven by cost saving incentives. Interestingly, when combining feedback and norms with a prize competition for achieving low energy consumption, the reduction effect – while present initially – disappears in the long run. This could suggest that external rewards reduce and even destroy intrinsic motivation to change behaviour.

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1. Introduction

Reducing overall energy consumption, as well as managing energy market volatility and demand peaks are increasingly important issues with the growing focus on decreasing greenhouse gas (GHG) emissions and controlling climate change. Internet connectivity and electronic innovations now allow energy providers to develop demand side management systems instead of only concentrating on supply side management. Using combinations of information feedback loops and grid management techniques, operators have the potential to improve the management of

energy market volatility and demand peaks. This would lead to lower energy production costs and reduced emissions. As one third of all greenhouse gas emissions come from residential energy consumption (EPA, 2015), understanding how social dynamics can impact household energy demand is an important step in this direction.

In this paper, we investigate the effects feedback information and norms, as well as prize competition, on energy consumption. We conduct a randomised control trial for a cohort of price-indifferent individuals at a student hall of residence in London. Our systematic literature review indicates that we are the first to test such a combination in this particular setting. We provide our subjects with individual as well as group/comparative feedback. A crucial factor of our design is that, because participants do not pay for their energy consumption, the information effect is not confounded by any cost saving incentives. This allows us to solely focus on the effects of behavioural interventions and norms as

* Corresponding author.

E-mail addresses: z.gurguc@imperial.ac.uk (Z. Gurguc), p.koutroumpis@imperial.ac.uk (P. Koutroumpis), r.martin@imperial.ac.uk (R. Martin), m.muuls@imperial.ac.uk (M. Muûls), tamaryn.napp@imperial.ac.uk (T. Napp).

opposed to price effects, which is present in other studies. We find that information mechanisms are strong: providing individuals with weekly feedback about their own consumption and their consumption relative to others leads to a 22% reduction in energy consumption on average. For a subset of our trial participants we combine the information treatment with a prize treatment; this group was promised a prize for the participant with the lowest energy consumption. This reveals an intriguing perverse effect. Whereas, for individuals with pure information treatment, the consumption effect is sustained throughout the trial, for the prize treated group the effect wears off completely after two weeks of treatment. We provide some evidence suggesting that this dropping off is caused by a reversal of efforts by individuals who realise that the prize is out of their reach as a consequence of the information treatment. This hints at a fundamentally different response mechanism when providing a prize: by strengthening external financial incentives, internal incentives such as the desire to reduce consumption because of detrimental social effects – e.g. through pollution – are weakened.

The focus of this paper is on household energy consumption, a key sector when considering energy efficiency and GHG emissions reductions. For example, in the UK, the domestic sector accounted for 27% of overall energy consumption in 2014¹ (DECC, 2015a) and 14% of total UK carbon emissions in 2013 (DECC, 2015b). These figures are expected to increase even further due to population growth and highlight the sector's growing importance. Statistics from the US and Western Europe reveal similar trends (Abrahamse et al., 2005; Gardner and Stern, 2002). In this context, as McMichael and Shipworth (2013) state: “various institutions are trying to encourage the adoption of behavioural energy-efficiency innovations through policy, building regulations and other measures such as direct engagement with communities and constituents”.²

Our research relates to a vast literature analysing the factors that affect energy use in the residential domain. As described in Costa and Kahn (2013), household electricity consumption depends on individual choices and house characteristics, appliances and the intensity of their utilisation which are linked to the local climate, prices as well as the consumer's personal attributes and behaviour. At the macro level, factors including technological developments, demographic factors, household income and economic growth are also likely to affect consumption outcomes (Abrahamse et al., 2005). Additionally, Hori et al. (2013) show that regulation aimed at reducing energy use is much more effective in the industrial than in the residential sector. These results indicate the need to discover mechanisms that effectively induce lower energy consumption at the household level.

This paper also relates in particular to the literature on the behavioural dimension of energy use. As reviewed by Lopes et al. (2012), this subject pertains not only to economics but also to psychology (Biel and Thøgersen, 2007; Frederiks et al., 2015). From an economics point of view, the base assumption will be that individuals are taking rational decisions when deciding on their energy use (Breukers et al., 2011; Wilson and Dowlatabadi, 2007). However, energy and electricity are not typical consumer products. These are rather an abstract, invisible, intangible and indirect by-product of other economic choices (Fischer, 2008). For example, Kempton and Layne (1994) compared energy consumption to shopping without price tags given that the customer only gets a quarterly bill.

Given these aforementioned characteristics, previous studies have examined dynamic pricing of electricity and shown that it

effectively switches consumption from peak hours to non-peak hours during which it's priced lower (for a comprehensive review see Faruqui and Sergici (2014)). Despite these results, it has been demonstrated that decreasing overall energy consumption only through dynamic pricing is challenging (Faruqui and George, 2005; Faruqui et al., 2010). While some studies show a ‘short-term effect of financial rewards’ (Abrahamse et al., 2005), others conclude that effects of financial rewards for energy conservation are large and persistent over time (Dolan and Metcalfe, 2015). Additionally, policy makers are often wary of using imperfectly designed financial incentives that can distort behaviour and lead to undesired consequences for financially constrained portions of the population or the elderly, for example, by increasing health risks associated with reduced heat consumption (Barnicoat and Danson, 2015). As Buchanan et al. (2015) state, households already suffering from fuel poverty have little capacity to further reduce their energy consumption. Finally, the cost dimension of the energy savings also relates to rebound effect (Khazzoom, 1980; Saunders, 1992), i.e. households saving money from consuming less energy may spend their additional income on activities that can generate more emissions.

As an alternative to financial incentives, existing research has also analysed the importance of information, or feedback mechanisms, and their impact on energy use. Feedback entails providing information to households about their energy consumption or savings, and is a strategy often employed by energy conservation initiatives. The effectiveness of different types, frequencies, duration of feedback on reducing energy use differs at the group, or even individual level (Abrahamse et al., 2005). One possible channel for a potential effect of feedback mechanisms could be that they “rematerialize” energy consumption (e.g. Buchanan et al., 2014).

Norms have been conjectured to be another meaningful channel through which information and feedback will impact energy consumption. They can be descriptive or injunctive; the former simply inform about others' performance while the latter directly suggest what should be done. Feedback that is augmented with a norm, i.e. direct comparison with ‘average’ or ‘normal’ behaviour may prove more powerful. Thaler and Sunstein (2008) consider that this feedback bypasses the consumer's decision-making process and acts as a heuristic shortcut or “nudge”. Additionally, Fuster and Meier (2010) suggest that financial incentives could be effective if they manage to change the social norm. The literature on the effectiveness of norms is rather inconclusive. Fischer (2008) reviews studies from 1987 to 2006 and finds that norms may not be an important element of feedback, as they do not affect consumption. More recent studies show on the contrary that norms do have a measureable impact on household consumption but some also argue that they can cause a boomerang effect³ (see for example Ayres et al. (2013), Nolan et al. (2008) or Schulz et al. (2007)). However, Harries et al. (2013) recently address a limitation of these studies: one should differentiate between the impact of pure feedback and that of norms. They find that the effect of norms is not statistically significant. Allcott and Rogers (2014) report how a utility company in the USA called OPOWER mailed home energy use reports, including social comparisons, to a selection of its customers. They find that it leads to energy consumption reduction, but that the frequency of the reports affects the persistence of their effect. Others demonstrate that social interaction and norms play a role in inducing energy saving behaviours at a decreasing rate over time (Dolan and Metcalfe, 2015; Hori et al., 2013). Additionally, post-consumption

¹ Energy consumption by the domestic sector was 38,162 thousand tonnes of oil equivalent (DEC, 2015a).

² p.1 McMichael and Shipworth (2013)

³ Informing low energy consumers about the group norm may inadvertently inspire them to increase their energy consumption.

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