



# Energy consumption, cultural background and payment structure



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## ARTICLE INFO

### Article history:

Received 22 May 2014

Received in revised form

19 December 2014

Accepted 27 January 2015

Available online 7 February 2015

### Keywords:

Energy consumption

Incentives

Energy conservation

Crowding theory

Cultural background

Culture

## ABSTRACT

In order to reduce the ecological footprint of households and mitigate anthropogenic climate change, policy makers need to understand which incentives drive household energy consumption. Economists tend to rely solely on financial instruments, but these might have unintended consequences on energy consumption through 'non-economic' channels. According to what we call the *Hackett-Lutzenhisser hypothesis*, the relation between households' cultural background and their energy consumption differs under different payment structures. The electricity consumption of households in the Netherlands is categorized according to two different payment structures: unit metered, where households pay for their private electricity consumption and master metered, where electricity costs are lump sum included in the rent. Our findings show that the range of variation in electricity consumption across cultural backgrounds is lower among unit metered than among master metered households, in line with the Hackett-Lutzenhisser hypothesis. The policy implication is that consumers' preferences cannot be simply taken as given, as is customary in standard economic models, but interact with the structure of financial incentives. Taxes and subsidies, or fixed and flexible rates in energy bills, not only change relative prices but may also interact with people's preferences.

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## 1. Introduction

To design policies which aim to more environmental-friendly behavior of households, policy makers need to understand which incentives will reduce households' energy consumption (Benabou and Tirole 2006; Galarraga et al., 2011 provides an overview of the energy consumption literature). Economists tend to focus on financial incentives such as taxes and subsidies which change relative prices, e.g. a carbon tax raises the relative price of carbon-intensive goods and a subsidy for solar panels reduces the price of clean electricity. However, to fully understand the effect of financial incentives on households' energy consumption, non-economic drivers are also relevant (Bartiaux, 2007; Green, 2004; Lutzenhisser, 1993).

Firstly, because the significance of non-economic factors – psychological, social and cultural – in household energy consumption has been established in various studies (Stern, 1999;

Sütterlin et al., 2011; Wilhite et al., 1996). McMakin et al., 2002 document research that show that economic factors do not fully explain energy use behavior as, for instance, consumers may ignore strong financial incentives to conserve energy, while other consumers continue to conserve energy even after the financial incentive was abolished or reduced. Desmedt et al. (2013) report about a Belgian project to influence household energy consumption by different tools, among which an energy diary, an extensive energy advice informing the household on potential savings in heating and electricity and an electrical audit, limited to electrical appliances only. One of the conclusions of their study (Desmedt et al., 2013, 462) is that "households decide on interventions to save energy in similar ways as they decide on other types of consumption. The consumption has to express a certain message. This means that invisible interventions like wall insulation or boiler replacement are seriously put at a disadvantage". By installing solar panels or a solar boiler on the roof, one can signal to the world that one is concerned with the environment, but this signal is not produced with interventions that are invisible, although their energy saving potential may be far higher. Moreover, a household may use its financial savings from an intervention which is visible to the

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social environment, like solar panels, to consume more energy through less visible kinds of energy consumption, like flying to more distant destinations for holidays. This 'rebound effect' is related to the Jevons Paradox, which states that improvements in energy efficiency can even lead to higher total energy consumption (Polimeni et al., 2008). Although the Jevons Paradox is based on a micro-economic argument, it may be deeply intertwined with social contexts which, according to Desmedt et al., 2013, define in which (visible) areas households feel socially compelled to save energy and in which (invisible) areas they feel less constrained to consume energy. In short, it seems to make sense to place "consumption in a broader and more social context than that of the individual 'decision maker'" (Hackett and Lutzenhiser, 1991: 466).

Secondly, because the financial incentives designed to change energy consumption patterns may have unintended consequences through these non-economic channels (Bowles, 2008; Dolan and Metcalfe, 2013; Gneezy et al., 2011). Frey and Jegen (1999, 2001) provide a long list of empirical examples of crowding effects where monetary incentives undermine (crowding-out) or strengthen (crowding-in) intrinsic motivations in order to show that the interaction between economic and non-economic drives is empirically relevant rather than just a theoretical possibility. Perhaps the most famous crowding effects are those where financial rewards for volunteers actually reduce their efforts (Halvorsen, 2010), like the claim of Titmuss that a voluntary system for blood donation gives better outcomes than a system of providing financial rewards (Titmuss, 1970) and that the introduction of a monetary fine increased the number of parents who came too late to pick up their children in a daycare centre in Israel (Gneezy et al., 2011).

The overarching hypothesis of this paper is that the strength of non-economic drivers of households energy consumption differ under different financial incentives or payment structures. More specifically, the hypothesis tested is that the introduction of a price mechanism, which provides a direct financial reward for household energy saving, simultaneously weakens the correlation between the cultural backgrounds of households and their energy consumption. This is what we call the Hackett-Lutzenhiser hypothesis, named after an article by the sociologists Bruce Hackett and Loren Lutzenhiser (1991, hereafter abbreviated as HL) who observed this effect in a California apartment complex. When the culturally diverse residents changed from 'master metering' (in which the electricity costs are included as a fixed cost in the rent) to 'unit metering' (in which each household pays an energy bill for its own electricity consumption, that is tenants are billed for individual measured energy usage), the explanatory power of the residents' "culture of origin" on their electricity consumption became significantly smaller. Under master metering, there was a significant correlation between the level of electricity consumption and the residents' cultural background, while after the transition to unit metering, Latin Americans, Asians and Europeans all started to consume relatively equal levels of electricity on average. Electricity consumption became socially 'neutral' according to HL – neutralizing the role of cultural background in electricity consumption. To use the idiom of crowding theory: the price mechanism seemed to 'crowd out' the influence of cultural background on energy consumption.

To test whether this neutralizing effect of unit metering also applies to Dutch households, we will analyze the relation between cultural background (hereafter abbreviated as background) and electricity consumption for unit metered and master metered households using a cross-sectional dataset from WoON (2012). WoON (2012) is a large government sponsored project in which a large number of characteristics from around 69 thousand Dutch households are collected every three to four years, including data on electricity, gas and water consumption. This dataset provides

information on Dutch households' electricity consumption and their backgrounds in three categories (native Dutch, non-Western immigrants and Western immigrants). The results only provide weak evidence for the hypothesis that unit metering weakens the relation between background and energy consumption.

For policy makers, the HL hypothesis is of practical use in the design of energy conservation policies. Policy makers may for instance realize that among master metered households, cultural habits which are wasteful in terms of energy consumption can be combatted by introducing a financial incentive to save energy (unit metering). At the same time, policy makers should realize that a price mechanism comes at the cost of eliminating culturally shaped 'good' habits in terms of energy behavior, because a price mechanism may "suppress social identities" by instilling an "economizing behavior" in consumers, as HL (1991) assert. Simultaneously, the HL hypothesis suggests that even among master metered households with no financial incentive to save energy, there is scope for policy makers to influence energy consumption through a 'cultural channel' as there is a relatively strong relation between background and energy consumption among these households. Policy makers could look for ways to use this correlation among master metered households for a cause, for instance by influencing households' cultural habits directly in order to limit their energy consumption indirectly.

A multidisciplinary approach to study energy consumption, combining insights from economics and sociology, is adopted in order to find out the relation between energy consumption on the one hand and cultural background and payment method on the other hand. This paper is structured as follows. Section 2 provides the reasoning behind the HL hypothesis and summarizes the research method used by HL. Section 3 explains our data and method, highlighting the differences with HL and its implications. Section 4 presents and discusses the results. Section 5 summarizes and concludes.

## 2. The Hackett-Lutzenhiser hypothesis

"[S]eemingly innocent variations in modes of payment for resources consumed, or payment structures, are in fact social structures - so that changes in them involve changes in status relations and hence implicate consumption patterns." - HL (1991: 466)

HL (1991) researched the effects of a change in billing method in a culturally diverse California apartment complex, inhabited by Asians, Europeans, Latin Americans, Africans and tenants from the Middle East. Overnight and for all apartments simultaneously, the billing method was changed during the summer of 1985 from master metering with energy costs included in the housing rent to unit metering in which each household was billed for their individual energy consumption. Using panel data of residents' electricity consumption, they observed a large drop in electricity consumption among all income classes and across all backgrounds.<sup>1</sup> For our purposes even more salient is their finding,

<sup>1</sup> Combining their data research with field observations, HL (1991: 457) noticed how virtually all income classes "simply turned off their air conditioners" after the change to unit metering, which could not be explained by income and price variables. This act of turning off air conditioners "brought almost everyone to the same consumption level". They argued that "aggregated (and perhaps preset or "fixed") costs are intrinsically less painful than disaggregated or variable costs, even where the totals involved are the same. A more social version of this argument would hold that a *shared* cost is easier to assume than a personal or private cost of the same amount" (HL, 1991: 461).

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