The Myth of the Unscrupulous Energy User's Dilemma: Evidence from Switzerland

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Abstract Heating and warm water consumption are frequently billed based on actual consumption, and this approach can be assumed to provide a financial incentive to energy consumers to opt for energy-conserving behaviour (e.g. reducing the room temperature, or using warm water economically). In many multi-flat buildings in Switzerland, tenants and homeowners still receive a heating and warm water bill that is based on a flat rate that depends on the size of the dwelling, rather than a bill that is based on the amount of energy actually consumed. In such a situation, there may be a social dilemma that leads to non-cooperative behaviour; economic theory predicts that households would choose a strategy of not sacrificing their level of comfort and, therefore, would not opt for energy-conserving behaviour. Psychological theory, on the other hand, suggests that a change in billing type might not, in and of itself, be a sufficient motivator to promote energy-conserving behaviour. This study aims to gain insight into Swiss consumers' underlying motivations in conserving energy. It empirically tests whether and how a difference in billing type affects consumers' current stated energy behaviour and their stated intention to conserve energy in the future. In neither of two separate studies was there any evidence of such a possible unscrupulous energy user's dilemma. Thus, on its own, consumption-based billing might not lead to significant changes in consumer behaviour. However, it could constitute an essential part of a wider behaviour modification programme that includes more effective billing and direct feedback programmes.

Keywords Energy Consumption · Energy Billing · Water Consumption · Consumer Policy · Survey

Introduction

Human-induced greenhouse gas (GHG) emissions have significantly increased since the pre-industrial era, making it the most dominant driver of observed climate warming since the mid-20th century (International Panel on Climate Change 2014). As avoiding dangerous climate change requires coordinated actions by numerous countries worldwide, many governments have established national GHG reduction targets. Switzerland, for instance, aims to reduce by 2020 its domestic GHG emissions by at least 20%, relative to its 1990 level (Swiss Federal Office for the Environment 2015a). Carbon dioxide (CO_2) accounts for approximately 82% of all Swiss GHG emissions, making it the most prevalent GHG produced by humans (Swiss Federal Office for the Environment 2015b). CO_2 is mainly emitted during the fossil fuel combustion process, for energy and transportation purposes; these fuels include coal, oil, and natural gas (International Panel on Climate Change 2007). With this in mind, the Swiss Federal Council drew up a long-term energy policy ('Energy Strategy 2050') and developed a package of different measures, with the aim of securing a sustainable energy supply in the future (Swiss Federal Office of Energy 2016).

Swiss households play a crucial part in achieving their country's long-term targets. In Switzerland, the residential household sector accounts for around 29% of all direct energy consumption, not including mobility-related consumption. Heating and warm water consumption together constitute the largest share of final direct energy consumption among private households in Switzerland (70.7% and 12.5%, respectively) (Swiss Federal Office of Energy 2014). Therefore, to meet Switzerland's energy objectives, targeting the household sector will be indispensable. In this respect, it is clear that technological advancements (e.g. the installation of energy-efficient heating systems) and an increase in the availability of renewable energy will not alone suffice in reducing GHG emissions; it is generally accepted that behavioural changes on the demand side, through energy conservation, will also be required (Burger et al. 2015). One major reason for this is that Switzerland has the lowest rate of home ownership in Western Europe: 55.8% of all homes are rented, while 37.6% are owned (Swiss Federal Office of Statistics 2015). A large proportion of the Swiss population comprises renters who have only limited possibilities in opting for technical solutions. Usually, it is the landlord or building owner that takes major investment decisions—including, for example, whether or not to insulate the walls of the house. Moreover, most rented flats in Switzerland offer a fully equipped kitchen (e.g. a fridge and an oven) and in-house access to laundry facilities (e.g.

washing machines and dryers). Thus, renters are typically unable to make capital investments that improve the in-home energy efficiency of household appliances.

In addition, a significant share (approximately 31%) of all homeowners in Switzerland own only one floor or a flat in a residential multi-family home, rather than a single-family home. When there are more than one owner in a building, several entities influence the decision-making process regarding the management of the building. In such a situation, consensus regarding energy-efficient retrofitting decisions might be quite difficult or take quite some time.

In contrast, behavioural measures such as turning down the room temperature when leaving the house can be practiced by everybody, as only small adjustments to daily habits are needed. However, since these measures are related to primal cultural norms associated with 'warmth', 'comfort', and 'wellbeing', such changes to daily practices are commonly perceived as sacrifices, and these measures typically require an enhanced effort or lead to reduced comfort (Poortinga et al. 2004; Stern 1992). In contrast to comfort sacrifices, energy conservation nonetheless brings about positive benefits for households, including environmental (reduced emissions) and financial (reduced cost) savings (Dogan et al. 2014). The question arises: which benefit motivates people most to conserve energy? When looking at what incentivizes people to opt for technological solutions such as energy efficiency measures (e.g. wall or roof insulation, boiler upgrades, etc.), a recent study by Aravena et al. (2016) showed that such investments are mainly driven by financial considerations, as people are mainly motivated by the potential to reduce their energy costs; environmental benefits, in contrast, are shown to be less relevant in households' decision-making. These findings are in line with similar research that focuses on households' motivations to adopt energy-efficiency measures at home (e.g. Mahapatra and Gustavsson 2008). One explanation for these findings could be that energy-efficiency measures such as better insulation in the home typically result in significant financial savings.

In contrast, energy savings from behavioural measures (e.g. reducing the room temperature during periods of absence) typically occur on a smaller scale. Given the lower possible financial savings that come with behavioural measures, the question that the current study aims to address is whether and how differences in billing type impact people's self-reported inclination to engage in energy-conserving behaviour. This insight is particular relevant for Switzerland, where many tenants and homeowners in multi-family homes receive a heating and warm water bill that is based on a flat rate per square metre, rather than an

individual energy bill. Previous related research by Diekmann and Preisendörfer (1991) revealed that tenants living in Munich, Germany (where tenants usually receive a bill based on actual consumption) were more likely to lower their heating setting when outside the house, compared to tenants living in Bern, Switzerland (who usually received a heating bill based on a flat-rate per square metre), despite showing similar levels of environmental concern. More precisely, the authors found that 69% of the Munich respondents indicated that they turned off their heating during longer periods of absence, whereas only 23% of the respondents from Bern did so (Diekmann and Preisendörfer 1991). In a separate calculation for the city of Bern that relates directly to the current study's research question, the authors calculated a total saving of approximately 20%, if all households were to receive a bill based on actual individual consumption (Diekmann and Preisendörfer 1998).

The current study contributes to the existing literature by conducting a survey of the impact of flat-rate versus consumption-dependent billing on current stated heating and warm water usage behaviour, and on stated intention to conserve energy in the future. The aim of this study is to investigate whether the findings reported in the study of Diekmann and Preisendörfer (1998) can be replicated in a different setting within a different canton (Study 1) or within a different target sample in Study 2 (surveying both tenants and owners of flats). However, it is not clear from the description of Diekmann and Preisendörfer's (1998) study design whether households with no control over their heating settings were being explicitly excluded from the statistical analyses, so as to ensure that any identified difference in energy-saving behaviour could be traced back to different billing structures (and not, for example, the inability to regulate the temperature at home). I therefore made sure to exclude from the analysis those respondents with no thermostat available in their household. In addition to that, this study also contributes to the existing literature not only by shedding light on consumers' underlying financial motivations in conserving energy, but also by investigating the influence of a set of various psychological factors.

In contrast to other recent contributions to the literature that measure the impact of financial incentives on changes to actual level of energy consumption (e.g. Dolan and Metcalfe 2013), this study relies on stated behaviour and intentions. The reason for this is that for a large proportion of renters in Switzerland, the energy consumption for heating and warm water purposes is measured only at the building level, and not at the individual household level. Thus, for my research purposes, it would be infeasible to rely solely on actual energy consumption data (e.g. measured via individual meters). As consumption data at the individual household

level are available only from those who receive a consumption-dependent bill, a survey investigating stated behaviour and stated intentions is well justified.

Background

Energy-saving behaviour typically results in financial savings. By reducing one's level of fossil fuel energy consumption, CO_2 emissions can be reduced and, concurrently, money can be saved on account of lower energy operating costs. Economic theory would assume that households would have a financial incentive to implement energy-conserving behaviour, such as decreasing the room temperature during periods of absence or being frugal with warm water consumption. However, there may be no such incentive in cases where tenants or homeowners in multi-family homes receive a heating and warm water bill that is based on a flat rate per square metre, rather than an individual energy bill that is based on actual consumption.

Such a situation is quite common to many multi-flat buildings in Switzerland, where many buildings are excluded from the legal requirement of installing meters to measure per-unit energy consumption for warm water and heating. Whereas in the construction of new buildings it is compulsory to install such meters, for old buildings, this is required only when they are being significantly refurbished. For instance, in the canton of St. Gallen, only in new buildings with seven or more units, and refurbished old buildings with more than nine units, must such individual metering equipment be installed (Canton of St. Gallen, 2015). To put this in perspective, only 11.2% of multi-family homes have 10 or more units, whereas 65% of all multi-family homes contain only two to five units; many buildings are thus excluded from the aforementioned legal requirements (Swiss Federal Office of Statistics 2015). In addition, a study commissioned by the Swiss Federal Office of Energy (2008) revealed that the requirements of the existing regulations in place for refurbished old buildings are not being fully met, because while several cantons do have regulations in place, they have not implemented appropriate enforcement activities to guarantee fulfilment of the obligations.

In many multi-flat buildings in Switzerland, tenants and homeowners therefore still receive a heating and warm water bill that is based on a flat rate; that rate is based on the size of the dwelling, and not on the amount of energy actually consumed. In a situation where households receive an energy bill that does not relate directly to one's own level of energy consumption, economic theory would predict that households would have an incentive to maximize selfish behaviour (i.e. not sacrifice energy use), since they face low marginal costs

for additional heating and warm water consumption. Thus, tenants might have an incentive to free ride by not sacrificing on their comfort level in order to save energy, as their energy consumption is to a large extent cross-financed by their neighbours in the building. In the following, this situation is called the 'unscrupulous energy user's dilemma'; this term is in line with Glance and Hubermann's (1994) discussion of the unscrupulous diner's dilemma, which touches on whether different billing arrangements (i.e. each person pays individually for his or her own meal, versus a single bill is evenly divided among a group of diners) significantly affects meal choices.

However, it must be seriously questioned, whether households that pay an energy bill in line with their individual consumption level would actually choose to pursue energy-conserving behaviour for financial reasons; after all, costs related to heating and warm water constitute only a very small part of the consumers' household budget in Switzerland. The median monthly income of Swiss households in 2011 amounted to CHF7,112, or CHF92,456 per year; 34% of household annual incomes were over CHF100,000. In contrast, according to the Swiss household budget survey of 2012, energy costs (excluding costs for electricity) were about CHF48 per month, or approximately 0.5% of the entire average household monthly expenses (Swiss Federal Office of Statistics 2014). A rule of thumb states that by turning down the heating temperature by 1°C, one could save up to 6% in energy costs (German Federal Government 2012); this translates into a monthly savings of less than CHF3 per household, and so it really is questionable whether households would consider the effort and loss of comfort related to these marginal savings worthwhile. (For a similar discussion, see Dogan et al. [2014].) Thus, given how low energy costs are (i.e. relative to total household income), people in Switzerland might simply not be mindful of energy bills, and this might limit the impact of individual billing on incentivizing people to conserve energy.

In addition, in social dilemma situations, people do not always act in their own interest, given that there are other, non-financial motives that lead people to cooperate (Steg 2003). Mazar et al. (2008), for instance, pointed out that although people are often tempted by economic benefits, they frequently cooperate in line with their internal value systems, which act as internalized benchmarks against which people compare their own behaviour. For the sake of maintaining an honest self-concept, people often decide to cooperate, as such behaviour drives them to evaluate themselves positively. Wasting too much energy might not be in line with people's perceptions of being a 'good neighbour'. Steg (2003) discussed a series of psychological motives that have an impact on degree of cooperation, including feelings of

responsibility, pro-social value orientations, personal norms, or when people believe that their own contribution will make a difference, to name a few (Allison and Messick 1990; Fleishman 1980; Kuhlman and Marshello 1975; Parks 1994; Schwartz 1977; Yamagishi 1986; cited in Steg 2003). Prior research has indeed shown that moral considerations and collective consequences (e.g. impact of own behaviour on the environment) influence people's energy-conserving decisions (Steg et al. 2015). For instance, several prior studies have shown that individuals who feel personally and morally obliged to conserve the environment are more likely to act in pro-environmental ways (Bamberg et al. 2007; Thøgersen and Ölander 2006). Thus, when such collective considerations prevail, people will also engage in energy-saving, even if the related financial benefits might not be worth the effort (c.f. Dogan et al. 2014; Heyman and Ariely 2004; Steg et al. 2014). People with strong normative goals will even perform the additional energy-conserving effort when only small environmental benefits derive therefrom (Dogan et al. 2014; Steg et al. 2014). One explanation that requires this reasoning is that people distinguish between two types of markets—namely, monetary versus social: monetary markets react strongly to the magnitude of compensation (e.g. energy savings), but social markets do not (Heyman and Ariely 2004). Accordingly, small financial rewards (e.g. only a few Swiss francs saved per month) will not suffice in incentivizing behaviour that aligns with additional effort (Dogan et al. 2014). In contrast, an individual who makes environmental considerations would still decide to conserve energy (e.g. by turning down the room temperature when leaving the house), even though the environmental benefits would be minor.

In addition to normative factors, many additional factors influence energy-conserving behaviour. Research has shown that people are most likely to intend to reduce household energy use when they hold positive attitudes towards energy conservation (e.g. Abrahamse and Steg 2011; Sütterlin et al. 2011). In addition, convenience factors impact pro-environmental behaviour, as people will be more willing to engage in energy conservation if it does not impinge upon their comfort (Gatersleben 2001; Sütterlin et al. 2011). However, positive attitudes towards energy conservation will lead to pro-environmental behaviour only when people feel that they are able to perform a certain behaviour ('perceived self-efficacy') and that their own actions can actually make a difference ('personal efficacy', or perceived consumer effectiveness) (Lindsay and Strathman 1997; Straughan and Roberts 1999; Sütterlin et al. 2011).

Despite the relevance of this issue, empirical evidence on the extent of the influence of flat-rate versus consumption-based billing on households' energy efficiency-related behaviour

is relatively limited. There is a broad body of literature available that investigates the price elasticity of, and the impact of different pricing structures on, energy demand; these studies examine time-dependent and time-independent tariffs, block-pricing, non-linear (marginal) pricing, critical peak pricing, time of use pricing, and real-time pricing (e.g. Ito 2014; Joskow and Wolfram 2012). Ito (2014), for instance, found that consumers do not respond to marginal (or expected marginal) price. The results suggest that non-linear pricing fails to contribute to the realization of energy-conserving goals.

Switzerland's consumption-independent billing structure—by which households receive a heating and warm water bill that is based on a flat rate consistent with the size of the dwelling—comes close to resembling the flat-rate tariffs seen in other areas (e.g. mobile phone, internet, fitness clubs, etc.), where consumers are charged a predefined lump sum, regardless of the quantity consumed (e.g. minutes called, megabytes downloaded, etc.). Prior research has shown that in these areas, consumers often prefer a flat-rate tariff—a preference consistent with what Train (1991) labels 'flat-rate bias'. This effect derives partly from the fact that people overestimate their future consumption; they also like to be 'insured' against possible higher bills in cases where future consumption levels are uncertain (Herweg and Mierendorff 2013; Lambrecht and Skiera 2006). Whereas the effect of the type of billing type on consumers' product choices is well documented (e.g. DellaVigna and Malmendier 2004), there is a relative dearth of literature with regard to how different tariffs impact usage behaviour (Robbert and Roth 2011).

In the area of resource conservation, related prior studies have shown that a shift from a flat-rate to a consumption-dependent billing, or *variable billing*, in fields such as household waste collection does have a significant impact on the amount of waste generated per household (e.g. Cuthbert 1994; Dahlén and Lagerkvist 2010) or the amount of domestic water used (Van Vugt 2001). More specifically, Van Vugt (2001) revealed in both a field study and in an experimental study that the imposition of a fixed tariff—where charges were not driven by consumption level—led to higher water consumption than a variable or per-use tariff. In addition, he showed that when people who were billed a fixed-rate tariff possessed a strong sense of community, they consumed less water than those billed a fixed-rate tariff and who had negligible community identification (Van Vugt 2001). Russel and Fielding (2010) concluded that when price and consumption level are unrelated, leveraging psychological factors—including a community identity and a shared sense of responsibility—is crucial when it comes to achieving water conservation goals.

Related to energy consumption, Gillingham et al. (2012) found that when the energy bill comprised part of the rent and was paid by the landlord, tenants were less likely to change their heating setting at night. Similarly, Levinson and Nieman (2004) found that tenants who live in flats where the energy bill comprises part of their rent were more likely to set their thermostats at higher levels during the winter months when away from home than those who paid individually for their bill. In addition, Hackett and Lutzenhiser (1992) also found that changing the billing method from 'master metering' (i.e. electricity costs are part of the rent, in the form of a fixed cost) to 'unit metering' (i.e. households pay their energy bill individually, based on actual consumption) led to a significant decrease in electricity consumption across all households. Additionally, a recent study by Beunder and Groot (2015) investigated the electricity consumption of master-metered versus unit-metered households; they found that in the latter category, income had an effect on the level of electricity consumption. The question, however, arises to whether the same effect can be found when it is not the landlord paying for the energy bill, but rather that the bill is split among all tenants of a building based on a flat rate that depends on the size of the dwelling, as it is predominantly the case in Switzerland.

Study 1

Study Sample

Study 1 was conducted in St. Gallen, a canton of approximately 478,709 inhabitants in eastern Switzerland. The target group of Study 1 comprised tenants living in multi-family flats who were able to exert control over their heating settings. Potential respondents were contacted in January 2012 through a letter of invitation that was distributed through the main tenant association in St. Gallen. A total of 1,400 residents were sent an email requesting their participation in the project, which they were told related to household energy consumption behaviour. As an incentive for participating in the survey, the respondents were offered the opportunity to participate in a sweepstakes with a chance to win various prizes. Of the original 1,400 invited residents, 447 tenants started the survey, and 404 completed it. Study participation was anonymous, and the respondents were assured that their data would be treated confidentially.

For the data analysis, however, the inclusion criterion was that respondents had control of the temperature settings in their home. Since 65 of the respondents (i.e. approximately 16% of all respondents) could not exert control over their temperature setting because of the lack of thermostats in the home (or for other reasons), they were excluded from the sample. Moreover,

24 tenants were excluded who were renting a single-family home. Thus, this study focused solely on tenants living in multi-family flats, to ensure that only those people who could face a potential dilemma were included in the survey. Finally, 315 complete dataset records were available for analysis.

Potentially, the sample is not fully representative of the total population of tenants living in the canton of St. Gallen, as only members of the tenant association were invited to participate in the survey. For this reason, the study results can be considered representative only of the members of the tenant association of the canton of St. Gallen who are connected to the Internet. Nevertheless, the sample remains a subpopulation of interest, from the standpoint of cultural models of energy conservation (Lutzenhiser 1992). In addition, the study was designed to examine the relationships among the key variables in the sample, which makes the dataset suitable for interpersonal comparisons.

Of the 315 tenants in the sample, 163 respondents (51.7%) received an individual bill based on actual consumption, and 123 (39.0%) respondents received a bill that was based on a flat rate per square metre. Finally, 29 respondents (9.2%) were not aware of the basis on which their energy bill was calculated. Table 1 presents the details of the sample's composition.

Insert Table 1 about here

Procedures and Measures

Survey data were collected through self-administered questionnaires. First, the respondents were asked whether they had the option of regulating the temperature in their house. The respondents were then asked whether they commonly reduce the room temperature of the living room when leaving the house ('yes/no'). If the respondents lived in a household that was always occupied at any given time, they had the option of choosing the response 'No, as our home is always occupied'.

To identify the respondents' current warm water consumption behaviour, three different activities were listed; the respondents were asked to indicate, using a five-point Likert scale, how often they performed each of these three activities—namely, 'Turn off water while soaping and shampooing hair', 'Turn off water while shaving and/or brushing teeth', and 'Fully

fill up the washing machine'. For warm water-conserving behaviour, the mean of the three underlying items was computed.

Next, respondents were asked to indicate whether they would be willing to sacrifice their comfort in order to save energy for (a) heating purposes (e.g. by putting on a sweater instead of increasing the room temperature). The respondents were also asked whether they would be willing to sacrifice their comfort in order to save energy for (b) warm water purposes (e.g. by taking shorter showers). The variables of these last two questions were coded to make the scores range from 1 ('never') to 5 ('always'). For willingness to sacrifice comfort in order to conserve energy in the future, the mean of these two underlying items was calculated. Previous research has shown that changes to daily practices are commonly perceived as sacrifices (Poortinga et al. 2004; Stern 1992), and so this question sought to directly investigate people's intentions to conserve energy when this trade-off was made explicit. Finally, the respondents were asked several questions pertaining to demographics (see Table 1).

Results of Hierarchical Regression Analyses

In the next step, hierarchical linear and logistic regression analyses were conducted to investigate the influence of socio-demographic variables and the type of billing system on (a) the likelihood of reducing room temperature when leaving the house (Table 2), (b) warm water-conserving behaviour (Table 3), and (c) the intention to sacrifice comfort to conserve energy for heating and warm water purposes (Table 4). Linear regression models were used when the dependent variable was considered continuous (e.g. warm water behaviour as measured on a five-point Likert scale), whereas logistic regression was used when the dependent variable was categorical (e.g. binary variable of likelihood to reduce room temperature during periods of absence). In all three models, the respondents' demographic variables were first entered into the equation as control variables.

Insert Table 2 about here

Insert Table 3 about here

Insert Table 4 about here

The first model of the logistic regression analysis—related to the reduction of room temperature during periods of absence—did not derive significant results. I excluded from this model those tenants who indicated that their home was never unoccupied, as the question did not relate to them.

In the other two hierarchical linear regression analyses—which predicted current warm water-conserving behaviour and willingness to conserve energy for heating and warm water purposes—there were no statistically significant changes in R^2 when the billing type was introduced into the equations, after controlling for the demographic variables of gender, age, household size and income. As shown in Table 3, the combination of all the variables (excluding the billing type) accounted for 6.4% of the variance of analysis for variables that predicted current warm water-conserving behaviour. In the linear regression model related to current warm water-conserving behaviour, the demographic variables of age and household size positively influenced warm water-conserving behaviour. The older the respondent was, the higher his or her level of energy-conserving behaviour was in relation to warm water consumption. In this model, there was no increment in the total variance explained by the introduction of the billing type. As shown in Table 4, the combination of all the variables (excluding the billing type) accounted for 9.2% of the variance of analysis for variables that predicted willingness to sacrifice comfort in order to conserve energy for heating and warm water purposes. The increment in the total variance explained by the introduction of the billing type was very small, as it added only 0.6% to the explained variance. In this linear regression model, age positively influenced the willingness to sacrifice comfort in order to conserve energy for heating and warm water purposes. In addition, people who were not willing to indicate their household income were less willing to sacrifice comfort for energy-conserving

purposes, compared to people belonging to households with the reference monthly income level of CHF5,001–7,000. The general assumption in much economic research that the billing type influences current warm water-conserving behaviour and the intention to conserve energy could not be confirmed by the results of Study 1.

Study 2

In Study 1, only a limited amount of information was collected from the survey participants. Therefore, it was decided that a second survey would be executed, where several variables would be added to control for psychological factors (e.g. personal norms) that could influence energy-conserving behaviour and the intention to conserve energy in the future. Moreover, in Study 2, also owner–occupiers living in multi-family homes were included—not just tenants, as was the case in Study 1. Frequently, owner–occupiers living in multi-family homes are additionally confronted with the situation wherein they receive a bill for heating and warm water consumption that is based on a flat fee consistent with the size of the flat, rather than on actual consumption.

Study Sample

The target respondents were people living in the German-speaking part of Switzerland who were able to exert control over their heating settings. The respondents were recruited in March 2015 from a Swiss online access panel by Respondi AG, through an email invitation. The market research company continuously built the sample until the target sample size of 600 respondents was reached. Of the 822 respondents who started taking the survey, 149 (approximately 18%) were excluded, since they indicated that they could not exert control over their in-home heating setting. Given this recruitment strategy, it was not possible to report on a final response rate (i.e. the percentage of respondents who actually participated in the survey compared to the total number of potential interviewees who were approached by the market research company).

An additional 65 respondents did not finish the survey; they were therefore excluded from the analysis. In addition, for the data analysis, only tenants and owner–occupiers living in multi-family homes were included; for this reason, and additional 100 homeowners who were living in single-family homes were excluded from further analyses. Ultimately, 508 completed surveys were available for analysis, and Table 5 presents details on this sample. It is important to note that the sample captured through this survey is not fully representative of the general population of Switzerland. However, this is not a critical issue, as the primary focus of this

paper is to identify factors that affect self-reported inclination to engage in energy-conserving behaviour.

Of the 508 occupants in the sample, 321 respondents (63.2%) received an individual bill based on actual consumption, and 132 (26.0%) respondents received a bill that was based on a flat rate per square metre. Finally, 55 respondents (10.8%) were not aware of the basis by which their energy bill was calculated. The absolute number of respondents who indicated that they receive a bill based on a flat-rate, per-square-metre basis needs to be interpreted with care: it might not reflect the actual market figures, given that some people are possibly billed based on their actual consumption, but are not aware of this. To measure the impact of billing type on stated behaviour and intentions to conserve energy, I considered the 'perceived' billing type as being more relevant with respect to actual behaviour; in the context of this study, it is more important to consider how people *believe* they are billed than how they are actually billed. (For a similar discussion, see the study of the Swiss Federal Office of Energy [2008].)

Insert Table 5 about here

Procedures and Measures

The survey questionnaire contained several sections. In the first part, the respondents' energy-saving behaviour and efforts were measured. Three questions were included, which led to two independent variables; these were meant to identify the respondents' (a) actual heating behaviour and (2) willingness to sacrifice future comfort in order to conserve the energy used for heating and warm water. With regard to their actual behaviour, the respondents were asked to indicate on a five-point Likert scale how frequently they reduced the temperature of their flat when they left the house. Unlike in Study 1, data captured through a Likert scale were collected and ranged in line with the following response options: (1) 'Always', (2) 'Often', (3) 'Once in a while', (4) 'Rarely', and (5) 'Never'. The change in response options relative to that in Study 1 was made to offer respondents a gradation of responses.

With regard to willingness to conserve energy in the future, the respondents were asked two questions—namely, whether they would be willing to sacrifice comfort in order to (1) reduce the energy needed for heating (by putting on more warm clothes than usual) and

(2) reduce the energy needed for warm water use (e.g. by taking shorter showers). The linear regression model used the mean score of these two items combined.

Subsequently, the survey participants were asked about the type of billing they received. The respondents could indicate that their energy bill was based on actual consumption, that their energy bill was based on a flat-rate based on the size of their dwelling, or that they did not know what kind of billing system was applied in their building.

In addition, based on Sütterlin et al. (2011), a selection of various psychosocial factors were measured, including self-efficacy, personal efficacy, personal norms, basic convictions, and loss of comfort (see Table 6). As described in the literature section, these factors have been shown to influence energy-conserving behaviour. While perceived self-efficacy relates to one's beliefs regarding the ability to engage in a certain behaviour, personal efficacy (or perceived consumer effectiveness) is one's belief that one's own behaviour can actually make a difference (Lindsay and Strathman 1997; Straughan and Roberts 1999; Sütterlin et al. 2011). Two items shown in Table 6 constitute the factor 'personal norms', which relates to one's moral obligation to behave in an environmentally friendly manner (Kaiser et al. 2005; Steg et al. 2005; Sütterlin et al. 2011). In addition to these questions, the respondents were asked to indicate the extent to which they agreed with a series of statements that reflected energy-related attitudes. Based on Sütterlin et al. (2011), four items were presented to the respondents, which constituted the factor 'basic convictions' (i.e. that underlie energy-saving behaviour). Additionally, one item formed the factor 'loss of comfort'. In the final section, the subjects answered socio-demographic questions (see Table 5).

Insert Table 6 about here

Results of Hierarchical Regression Analyses

To test what influences energy-conserving behaviour and the intention to conserve energy in the future, several hierarchical multiple regression analyses were performed. With this method, blocks of predictors were entered sequentially into a regression model, instead of all the variables being entered simultaneously, as is done in a standard multiple regression. The order of entry of the variables was planned *a priori* to control for the demographic variables and energy-related beliefs, before the billing type was entered in the final step. Only those variables

that showed a significant correlation with the dependent variable under consideration, at the $p < .05$ level, were included as covariates in the regression analyses. Since several categorical variables with more than two levels were included, those variables were recoded into a number of separate, dichotomous variables. Thus, two blocks of variables were entered into the hierarchical regression analyses, and I tested whether each block significantly increased R^2 overall, given the variables that had already been entered into the equation.

Regarding the hierarchical linear regression analysis for the variables that predict willingness to reduce heating settings at home (see Table 7), only the demographic variable 'gender' and a set of various energy-related beliefs that correlate with the dependent variable at the $p < .05$ level were added in Step 1; the billing type was added in Step 2. The combination of gender and energy-related beliefs accounted for only 5.1% of the variance. Of all of the variables that were entered into the equation in Model 1, only personal norms and gender emerged as significant predictors. In contrast, the inclusion of the type of billing in Model 2 did not contribute to explanations regarding the respondent's likelihood of reducing room temperature during longer periods of absence. In other words, the addition of the billing type in the Step 2 of the regression analysis did not have any independent contribution to explaining the heating behaviour under consideration.

Insert Table 7 about here

Another hierarchical linear regression analysis was conducted to test the impact of the various variables that predicted willingness to sacrifice comfort in order to conserve energy for heating and warm water purposes (see Table 8). Again, only those variables that showed a significant correlation with the dependent variable under consideration at the $p < .05$ level were included in the regression analyses as covariates. As shown in Table 8, the combination of all the variables (excluding billing type) accounted for 23.6% of the variance. When the variables in Step 1 were entered into the equation, the measures of personal norms, basic convictions, and loss of comfort, emerged as significant predictors. However, the increment in the total variance explained caused by the introduction of the billing type in Model 2 was very small and insignificant: it added only 0.3% to the explanation and increased the total explained variance in the willingness to conserve energy from 23.6% to 23.9%.

Insert Table 8 about here

Discussion and Conclusions

This study showed that independent billing alone might not guarantee energy-conserving behaviour. Both of the studies conducted in this research showed that consumption-dependent billing did not encourage people to conserve energy more so than flat-rate billing. Thus, the respondents appeared not to free ride to the extent that economic theory predicts. One explanation for these results could be that financial considerations might not play a very important role in the decision to conserve energy—at least not among households in Switzerland, a country with a generally high income level overall—even when consumption-dependent billing would be in place. Thus, given that the potential costs derived from changing heating and warm water consumption behaviour are relatively low compared to the overall available budget, financial considerations triggered by different billing types are assumed to be quite limited when deciding whether to sacrifice comfort in order to reduce energy consumption. Another explanation for these findings could be that people in social dilemma situations do not always act in their own interest, given that there are other, non-financial motives that lead people to cooperate in such situations, as described in the background section (Steg 2003).

The results of Study 2 herein showed that among several tested psychological variables, personal norms were found to significantly influence actual energy-conserving behaviour (measured by the likelihood to reduce room temperature when leaving the house) and the willingness to sacrifice comfort to save energy for heating and warm water purposes. Consumer policy could exploit these insights to generate personal normative messages when promoting energy-conserving behaviour (De Groot et al. 2013). According to the norm activation model (Schwarz 1977), two personality trait activators positively influence the formation of personal norms—namely, ‘awareness of consequences’ (i.e. being aware of the possible outcomes when not being involved in a certain behaviour) and ‘ascription of responsibility’, which relates to the feeling of being personally responsible for behaving in a certain way (Schwartz 1977). Campaigns could focus on these activators in order to boost personal norms, which could translate into more eco-friendly behaviour. For instance, campaigns could convey a message about the possible harmful effects of certain behaviours on the planet (such as climate change)

while simultaneously highlighting the personal responsibility of each citizen in helping to reduce the scale of the problem (Doran and Larsen 2016). Bolderdijk et al. (2012) and De Groot et al. (2013) each provide examples of how people's personal norms could be activated when persuasive normative messages use personal pronouns so as to make the personal norms more salient. De Groot et al. (2013) argue that the use of personal pronouns enables individuals to link beliefs about what would actually be 'the right thing to do' to the moral self-concept, which can in turn activate internalized norms; consequently, people could be stimulated to act more in line with these norms. Bolderdijk et al. (2012) undertook a field experiment, in which a moral appeal that used personal norms was placed on a sign positioned at a petrol station to attract customers to receive a free tyre check. The message appealing to personal norms ('Do you care for the environment? Get a free tyre check') was more effective in motivating customers to use the coupon for a free tyre check than the message pertaining to monetary benefits ('Do you care about your finances? Get a free tyre check') or a control appeal ('Get a free tyre check').

In order to increase people's awareness of consequences, which has shown to positively influence the formation of personal norms, information provision programs play a crucial role. Informational strategies are key in overcoming two of the most prominent problems in the field of energy—namely, the invisibility of the environmental impact of everyday activities, and the low awareness among individuals of their own energy use and its impact (Attari et al. 2010; Delmas et al. 2013). Quite frequently, people do not pay attention to the use of unnecessary amounts of energy, given that energy is often invisible to them; it therefore often goes unnoticed that the light is still switched on or that the computer has not been turned off, for example. Even when people receive a bill that is based on their actual consumption, it does not mean that they are better informed about their everyday energy consumption. Often, only conventional electricity meters are used, and these are often located in the basement, where they are not visible on a daily basis; this leads to a lack of interaction and lack of awareness regarding energy consumption. Energy is often taken for granted, and the 'wake-up call' reaches the consumer only upon receiving the energy bill. Thus, while individual metering and billing alone will not lead to significant changes in consumer behaviour, it could constitute an essential part of a wider behaviour change programme, as the information needed for more informed decision-making regarding energy use could be provided. For instance, an independent billing procedure allows for the provision of better billing (e.g. by providing real-time and/or historic and comparative consumption feedback) or direct feedback via electronic consumption displays (i.e. in-home displays), for instance. As such measures could certainly

play a part in bringing about energy awareness, recent research has investigated whether differences in the impact on conservation behaviour can be found, depending on the type of information involved. Whereas financial feedback information is commonly applied, research showed that the provision of monetary information does not necessarily impact households' energy behaviour (Lindén et al. 2006). Delmas et al. (2013), for instance, showed that monetary (i.e. pecuniary) information strategies might not have a positive effect in promoting energy conservation, if the size of the possible monetary savings would be too small. Performing a meta-analysis, the authors showed that information on monetary savings actually *increased* energy usage. In a similar vein, Asensio and Delmas (2015) showed that non-price information strategies that promote environmental and health-based messages were more effective in motivating energy-conserving behaviour, compared to monetary savings information. Similarly, Dogan et al. (2014) showed that environmental feedback was more effective in motivating eco-friendly behaviour than the provision of corresponding monetary benefits. The authors conclude that when possible financial savings are not justified with regards to the additional effort involved, highlighting non-monetary benefits such as environmental savings would be more powerful in promoting pro-environmental behaviour. Future research could investigate various information strategies while focusing either on monetary or environmental aspects, and whether they would have a differential impact on people who receive consumption-dependent versus flat-rate billing.

Finally, it is essential to acknowledge the limitations of the current study. First and foremost, strictly speaking, it cannot be concluded from the survey results that the type of billing has no effect whatsoever on energy-conserving behaviour. The use in future studies of a larger sample size could potentially render more significant findings. Moreover, being an observational study, there are several potential confounds that cannot be excluded, given that households that are being billed in different ways might also differ in ways that affect the relevant behaviours and intentions under study. I aimed to take into account potential confounds from a number of socioeconomic and psychological covariates, but could not control for unobserved covariates that should be investigated. In addition, as with any stated preference survey, one limitation of this study is that there could be a gap between stated and revealed behaviour. Future studies could attempt to investigate the impact of different billing types on actual energy consumption behaviour. However, as described above, such research suffers from the limitation that no household-level consumption data are available for those households that are provided with a bill that is based on a flat rate that corresponds to the size of the dwelling. However, the research question could potentially be addressed by analysing actual energy

consumption data at the building level, both before and after installing individual metering equipment. In such a case, it would be important to design the research approach very carefully. Retrofitting houses with individual heating and warm water meters often happens alongside the implementation of other energy efficiency measures; undoubtedly, this often leads to noticeably lower overall energy consumption at the household level. This makes it difficult to measure the isolated effects of the introduction of consumption-based billing. Finally, this study was limited to Switzerland; thus, additional research is required to validate the generalizability of these results to other countries. In particular, it would be worth investigating whether the results of this study would apply to countries with lower overall levels of income, where energy costs constitute a larger share of the household budget.

References

Abrahamse, W., & Steg, L. (2011). Factors related to household energy use and intention to reduce it: The role of psychological and socio-demographic variables. *Human Ecology Review*, *18*, 30–40.

Allison, S. T., & Messick, D. M. (1990). Social decision heuristics in the use of shared resources. *Journal of Behavioral Decision Making*, *3*, 195–204.

Aravena, C., Riquelme, A., & Denny, E. (2016). Money, comfort or environment? Priorities and determinants of energy efficiency investments in Irish households. *Journal of Consumer Policy*, 1–28.

Asensio, O. I., & Delmas, M. A. (2015). Nonprice incentives and energy conservation. *Proceedings of the National Academy of Sciences, 112* (6), 510–515.

Attari, S. Z., DeKay, M. L., Davidson, C. I., & De Bruin, W. B. (2010). Public perceptions of energy consumption and savings. *Proceedings of the National Academy of Sciences*, *107* (37), 16054–16059.

Bamberg, S., Hunecke, M., & Blöbaum, A. (2007). Social context, personal norms and the use of public transportation: Two field studies. *Journal of Environmental Psychology*, *27*, 190–203.

Beunder, A., & Groot, L. (2015). Energy consumption, cultural background and payment structure. *Journal of Cleaner Production*, *94*, 137–143.

Bolderdijk, J. W., Steg, L., Lehman, P., Geller, S., & Postmes, T. (2012): Comparing the effectiveness of monetary versus moral motives in environmental campaigning. *Nature Climate Change, 3*, 413–416.

Burger, P., Bezençon, V., Bornemann, B., Brosch, T., Carabias-Hütter, V., Farsi, M., et al. (2015). Advances in understanding energy consumption behavior and the governance of its change - Outline of an integrated framework, *Frontiers in Energy Research*, *3*, 1–19.

Canton of St. Gallen (2015). Verbrauchsabhängige Heizkostenabrechnung (VHKA). Retrieved from: http://www.umwelt.sg.ch/home/Themen/Energie/VHM_Energie/bauten___anlagen/begriff___anforderungen/heizkostenabrechnung.html.

Cuthbert, R. (1994). Variable disposal fee impact. *BioCycle*, *35*, 63–65.

Dahlén, L., & Lagerkvist, A. (2010). Pay as you throw: strengths and weaknesses of weight-based billing in household waste collection systems in Sweden. *Waste management*, *30*, 23–31.

DellaVigna, S., & Malmendier, U. (2006). Paying not to go to the gym. *The American Economic Review*, *96*, 694–719.

Delmas, M. A., Fischlein, M., Asensio, O. I. (2013): Information strategies and energy conservation behavior: A meta-analysis of experimental studies from 1975 to 2012. *Energy Policy, 61*, 729–739.

De Groot, J. I., Abrahamse, W., & Jones, K. (2013). Persuasive normative messages: The influence of injunctive and personal norms on using free plastic bags. *Sustainability*, *5*, 1829–1844.

Diekmann, A., & Preisendörfer, P. (1991). Umweltbewusstsein oder Anreizstrukturen? Die Grenzen der Verhaltenswirksamkeit des Umweltbewusstseins. In W. Joussen & A. G. Hessler (Eds.), *Umwelt und Gesellschaft* (pp. 105–127). Berlin: Akademie Verlag.

Diekmann, A., & Preisendörfer, P. (1998). Environmental behavior discrepancies between aspirations and reality. *Rationality and Society*, *10*, 79–102.

Dogan, E., Bolderdijk, J. W., & Steg, L. (2014). Making small numbers count: Environmental and financial feedback in promoting eco-driving behaviours. *Journal of Consumer Policy*, *37*, 413–422.

Dolan, P., & Metcalfe, R. (2013). *Neighbors, knowledge, and nuggets: Two natural field experiments on the role of incentives on energy conservation*. London: Centre for Economic Performance.

Doran, R., & Larsen, S. (2016). The relative importance of social and personal norms in explaining intentions to choose eco-friendly travel options. *International Journal of Tourism Research, 18*, 159–166.

Fleishman, J. A. (1980). Collective actions as helping behaviour: Effect of responsibility diffusion on contributions to a public good. *Journal of Personality and Social Psychology*, *38*, 629–637.

Gatersleben, B. (2001). Sustainable household consumption and quality of life: The acceptability of sustainable consumption patterns and consumer policy strategies. *International Journal of Environment and Pollution, 15*, 200–216.

German Federal Government (2012). Richtig heizen – und Geld sparen. Retrieved from: https://www.bundesregierung.de/Content/DE/Publikation/Bestellservice/2012-10-23-faltblatt-richtig-heizen-und-geld-sparen.pdf;jsessionid=31E9D5B69E38B1D24DC1EA069AF921B4.s2t2?__blob=publicationFile&v=9.

Gillingham, K., Harding, M., & Rapson, D. (2012). Split incentives and household energy consumption. *Energy Journal*, *33*, 37–62.

Glance, N. S., & Huberman, B. A. (1994). The dynamics of social dilemmas. *Scientific American*, *270*, 76–81.

Hackett, B., & Lutzenhiser, L. (1991). Social structures and economic conduct: Interpreting variations in household energy consumption. *Sociological Forum*, *6*, 449–470.

Herweg, F., & Mierendorff, K. (2013). Uncertain demand, consumer loss aversion, and flat-rate tariffs. *Journal of the European Economic Association*, *11*, 399–432.

Heyman, J., & Ariely, D. (2004). Effort for payment a tale of two markets. *Psychological science, 15*, 787–793.

International Panel on Climate Change (2007). Human and natural drivers of climate change. Retrieved from: https://www.ipcc.ch/publications_and_data/ar4/wg1/en/spmsspm-human-and.html.

International Panel on Climate Change (2014). Climate change 2014 synthesis report – Summary for policymakers. Retrieved from: https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf.

Ito, Koichiro (2014). Do consumers respond to marginal or average price? Evidence from Nonlinear Electricity Pricing. *American Economic Review, 104*, 537–563.

Joskow, P. L., & Wolfram, C. D. (2012). Dynamic pricing of electricity. *The American Economic Review*, 102, 381–385.

Kaiser, F. G., Hubner, G., & Bogner, F. X. (2005). Contrasting the theory of planned behavior with the value-belief-norm model in explaining conservation behavior. *Journal of Applied Social Psychology, 35*, 2150–2170.

Kuhlman, D. M. & Marshello, A. F. (1975). Individual differences in game motivation as moderators or preprogrammed strategy effects in prison's dilemma. *Journal of Personality and Social Psychology, 32*, 922–931.

Lambrecht, A., & Skiera, B. (2006). Paying too much and being happy about it: Existence, causes, and consequences of tariff-choice biases. *Journal of Marketing Research, 43*, 212–223.

Levinson, A., & Niemann, S. (2004). Energy use by apartment tenants when landlords pay for utilities. *Resource and Energy Economics*, *26*, 51-75.

Lindén, A. L., Carlsson-Kanyama, A., & Eriksson, B. (2006). Efficient and inefficient aspects of residential energy behaviour: What are the policy instruments for change?. *Energy Policy*, *34*, 1918–1927.

Lindsay, J. J., & Strathman, A. (1997). Predictors of recycling behavior: An application of a modified health belief model. *Journal of Applied Social Psychology*, *27*, 1799–1823.

Lutzenhiser, L. (1992). A cultural model of household energy consumption. *Energy*, 17, 47–60.

Mahapatra, K., & Gustavsson, L. (2008). An adopter-centric approach to analyze the diffusion patterns of innovative residential heating systems in Sweden. *Energy Policy, 36*, 577–590.

Mazar, N., Amir, O., & Ariely, D. (2008). The dishonesty of honest people: A theory of self-concept maintenance. *Journal of Marketing Research*, 45, 633–644.

Parks, C. D. (1994). The predictive ability of social values in resource dilemmas and public goods games. *Personality and Social Psychology Bulletin, 20*, 431–438.

Poortinga, W., Steg, L., & Vlek, C. (2004). Values, environmental concern, and environmental behavior a study into household energy use. *Environment and Behavior, 36*, 70–93.

Robbert, T., & Roth, S. (2011). Auswirkungen von Tarifwahlentscheidungen auf die Nutzung von Dienstleistungen. In S. Fließ (Ed.), *Beiträge zur Dienstleistungsmarketing-Forschung* (pp. 149–173). Wiesbaden: Gabler.

Russell, S., & Fielding, K. (2010). Water demand management research: A psychological perspective. *Water Resources Research*, *46* (5), 1–12.

Schwartz, S. H. (1977). Normative influences on altruism. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 10, pp. 221–279). New York: Academic Press.

Steg, L. (2003). Motives and behaviour in social dilemmas relevant to the environment. In: L. Hendricks, W. Jager & L. Steg (Eds.), *Human Decision Making and Environmental Perception*. *Understanding and Assisting Human Decision Making in Real-Life Settings* (pp. 83–102). Groningen: University of Groningen, Department of Psychology.

Steg, L., Dreijerink, L., & Abrahamse, W. (2005). Factors influencing the acceptability of energy policies: A test of VBN theory. *Journal of Environmental Psychology*, *25*, 415–425.

Steg, L., Bolderdijk, J. W., Keizer, K., & Perlaviciute, G. (2014). An integrated framework for encouraging pro-environmental behaviour: The role of values, situational factors and goals. *Journal of Environmental Psychology*, *38*, 104–115.

Steg, L., Perlaviciute, G., & van der Werff, E. (2015). Understanding the human dimensions of a sustainable energy transition. *Frontiers in Psychology*, *6*, 1–16.

Stern, P. C. (1992). What psychology knows about energy conservation. *American Psychologist*, *47*, 1224–1232.

Straughan, R. D., & Roberts, J. A. (1999). Environmental segmentation alternatives: A look at green consumer behavior in the new millennium. *Journal of Consumer Marketing*, *16*, 558–575.

Sütterlin, B., Brunner, T. A., & Siegrist, M. (2011). Who puts the most energy into energy conservation? A segmentation of energy consumers based on energy-related behavioral characteristics. *Energy Policy*, 39, 8137–8152.

Swiss Federal Office for the Environment (2015a). Swiss climate policy. Retrieved from: http://www.bafu.admin.ch/klima/13877/14510/index.html?lang?en.

Swiss Federal Office for the Environment (2015b). Kenngrössen zur Entwicklung der Treibhausgasemissionen in der Schweiz. Retrieved from: http://www.bafu.admin.ch/klima/13879/13880/index.html?lang=de&download=NHzLpZeg7t,lnp6I0NTU042l2Z6ln1acy4Zn4Z2qZpnO2Yuq2Z6gpJCHdoN,gmym162epYbg2c_JjKbNoKSn6A--.

Swiss Federal Office of Energy (2008). Konzept, Vollzug und Wirkung der verbrauchsabhängigen Heiz- und Warmwasserkostenabrechnung (VHKA). Retrieved from: http://www.news.admin.ch/NSBSubscriber/message/attachments/13848.pdf.

Swiss Federal Office of Energy (2014). Analyse des schweizerischen Energieverbrauchs 2000 - 2013 nach Verwendungszwecken. Retrieved from: http://www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=de&name=de_523528791.pdf.

Swiss Federal Office of Energy (2016). Energy Strategy 2050. Retrieved from: http://www.bfe.admin.ch/themen/00526/00527/index.html?lang=en.

Swiss Federal Office of Statistics (2014): Haushaltsbudgeterhebung 2012
Einkommen und Ausgaben der Privathaushalte in der Schweiz. Retrieved from: http://www.bfs.admin.ch/bfs/portal/de/index/themen/20/02/blank/key/einkommen0/niveau.Document.159839.xls.

Swiss Federal Office of Statistics (2015). Wohnverhältnisse – Daten, Indikatoren, Bewohnertypen. Retrieved from: http://www.bfs.admin.ch/bfs/portal/de/index/themen/09/03/blank/key/bewohnertypen/entwicklung.html.

Thøgersen, J., & Ölander, F. (2006). To what degree are environmentally beneficial choices reflective of a general conservation stance?. *Environment and Behavior*, *38*, 550–569.

Train, K. E. (1991). *Optimal regulation: The economic theory of natural monopoly*. Cambridge, MA: MIT Press.

Van Vugt, M. (2001). Community identification moderating the impact of financial incentives in a natural social dilemma: Water Conservation. *Personality and Social Psychology Bulletin*, 27, 1440–1449.

Yamagishi, T. (1986). The structural goal/expectation theory of cooperation in social dilemmas. In E.J. Lawler (Ed.), *Advances in group processes* (Vol. 3, pp. 51–87). Greenwich, CT: JAI Press.

Table 1 Study 1: Characteristics of the sample (N = 315)

Characteristics and levels	**Mean (SD)**	***N***	***%***
Gender			
Female		155	49.2%
Male		160	50.8%
Age	46.0 (13.9)		
Number of people living in the household	2.2 (1.1)		
Monthly net income of the entire household			
Below 5,000 CHF		74	23.5%
5,001–7,000 CHF		84	26.7%
7,001–9,000 CHF		62	19.7%
Above 9,000 CHF		70	22.2%
Not specified		25	7.9%
Billing type			
Bill based on actual consumption		163	51.7%
Bill based on a flat rate per square meter		123	39.0%
Don´t know		29	9.2%

Table 2 Study 1: Logistic regression analysis for variables predicting reduction of room temperature ($N = 265$)[a]

	Model 1					Model 2				
Predictor variable	*B*	*SE*	*Wald*	Sig.	Exp(B)	*B*	*SE*	*Wald*	Sig.	Exp(B)
Constant	-0.989	0.605	2.674	.102	0.372	-1.205	0.642	3.522	.061	0.300
Age (in years)	0.010	0.010	1.120	.290	1.010	0.011	0.010	1.244	.265	1.011
Gender (0: male; 1: female)	0.349	0.257	1.851	.174	1.418	0.367	0.261	1.977	.160	1.443
People living in household	0.057	0.129	0.197	.657	1.059	0.077	0.130	0.349	.555	1.080
Income (reference: CHF 5001-7000)										
Below CHF 5000	0.087	0.355	0.059	.807	1.090	0.039	0.358	.012	.914	1.039
CHF 7001-9000	0.584	0.372	2.473	.116	1.794	0.579	0.375	2.381	.123	1.785
Above CHF 9000	-0.309	0.380	0.664	.415	0.734	-0.302	0.381	.627	.429	0.739
Not indicated	0.016	0.498	0.001	.974	1.017	-0.016	0.503	.001	.975	0.984
Billing type (reference: bill based on actual consumption)										
Bill based on a flat rate per square meter						0.312	0.273	1.304	.253	1.367
Billing type not known						0.213	0.454	0.220	.639	1.238
Chi-square Step						1.338			.512	
Chi-square Model	8.770			.270		10.108			.342	
-2 Log likelihood	356.932					355.594				
Nagelkerke R^2	.043					.050				

[a] Those respondents who indicated that their home was never unoccupied were excluded from this analysis.

Table 3 Study 1: Hierarchical linear regression analysis for variables predicting current warm water-conserving behaviour ($N = 315$)

	Model 1					**Model 2**				
Predictor variable	*B*	*SE*	*β*	*t*-value	Sig.	*B*	*SE*	*β*	*t*-value	Sig.
Constant	3.339	0.237		14.090	**<.001*****	3.351	0.249		13.461	**<.001*****
Age (in years)	0.009	0.004	.142	2.463	**.014***	0.009	0.004	.142	2.442	**.015***
Gender (0: male; 1: female)	0.086	0.100	.049	0.863	.389	0.082	0.102	.047	0.801	.424
People living in household	0.117	0.048	.143	2.432	**.016***	0.115	0.049	.141	2.366	**.019***
Income (reference: CHF 5001-7000)										
Below CHF 5000	-0.024	0.139	-.011	-0.170	.865	-0.020	0.140	-.010	-0.142	.887
CHF 7001-9000	-0.382	0.146	-.174	-2.623	**.009****	-0.379	0.147	-.172	-2.573	**.011***
Above CHF 9000	-0.295	0.143	-.140	-2.063	**.040***	-0.294	0.144	-.140	-2.048	**.041***
Not indicated	-0.470	0.197	-.145	-2.383	**.018***	-0.472	0.199	-.146	-2.375	**.018***
Billing type (reference: bill based on actual consumption)										
Bill based on a flat rate per square meter						-0.028	0.105	-.016	-0.270	.787
Billing type not known						0.011	0.180	.004	0.062	.950
Sig. of ANOVA	**.004****						**.014***			
R^2	.064						.065			
R^2 *change*							**<**.001			
F change	3.017						0.045			
Sig. F Change	**.004****						.956			

*p < .05, **p < .01, ***p < .001.

Table 4 Study 1: Hierarchical linear regression analysis for variables predicting willingness to sacrifice comfort in order to conserve energy for heating and warm water purposes ($N = 315$)

	Model 1					**Model 2**				
Predictor variable	*B*	*SE B*	*β*	t-value	Sig.	*B*	*SE B*	*β*	*t*-value	Sig.
Constant	3.070	0.266		11.543	**<.001*****	3.152	0.279		11.315	**<.001*****
Age (in years)	0.011	0.004	.159	2.802	**.005****	0.011	0.004	.146	2.552	**.011***
Gender (0: male; 1: female)	0.183	0.112	.092	1.628	.104	0.201	0.114	.100	1.759	.080
People living in household	-0.075	0.054	-.080	-1.381	.168	-0.077	0.055	-.083	-1.416	**.**158
Income (reference: CHF 5001-7000)										
Below CHF 5000	0.092	0.156	.039	0.593	.553	0.097	0.156	.041	0.621	.535
CHF 7001-9000	0.077	0.164	.031	0.469	.639	0.054	0.165	.022	0.329	.742
Above CHF 9000	-0.150	0.161	-.062	-0.932	.352	-0.160	0.161	-.067	-0.997	.319
Not indicated	-0.776	0.221	-.210	-3.502	**.001****	-0.745	0.223	-.202	-3.345	**<.001*****
Billing type (reference: bill based on actual consumption)										
Bill based on a flat rate per square meter						-0.038	0.118	-.018	-0.319	.750
Billing type not known						-0.282	0.201	-.082	-1.400	.162
Sig. of ANOVA	**<.001*****					**<.001*****				
R^2	.092					.098				
R^2 *for change*						.006				
F change	4.450					0.981				
Sig. F Change	**<.001*****					.376				

*p < .05, **p < .01, ***p < .001.

Table 5 Study 2: Demographic characteristics of the sample of study 2 (N = 508)

Characteristics and levels	**Mean (SD)**	***N***	***%***
Gender			
Female		250	49.2%
Male		258	50.8%
Age	43.6 (14.4)		
Number of people living in the household	2.4 (1.2)		
Children in household			
No		395	77.8%
Yes		113	22.2%
Highest level of education completed			
Required basic education		11	2.2%
(Basic) apprenticeship		224	44.1%
Fulltime trade or high school		37	7.3%
Gymnasium (Matura)		53	10.4%
Higher professional training		89	17.5%
University/college		94	18.5%
Monthly net income of the entire household			
5,000 CHF or below		132	26.0%
5,001–7,000 CHF		91	17.9%
7,001–9,000 CHF		69	13.6%
Above 9,000 CHF		108	21.3%
Not specified		108	21.3%
Billing type			
Bill based on actual consumption		321	63.2%
Bill based on a flat rate per square meter		132	26.0%
Don´t know		55	10.8%

Table 6 Study 2: Energy-related beliefs (N = 508)

	Mean	Standard Deviation
Beliefs		
Self-efficacy (1 item) • I know the areas of my household with the highest energy saving potential and, accordingly, I can/could optimize my consumption without any problems.	4.12	1.17
Personal efficacy (1 item) • The small efforts I make to conserve energy add up, too, and can make a difference with regard to general energy consumption.	4.46	1.08
Personal norms (2 items) • I feel personally obliged to avoid unnecessary energy consumption wherever possible. • I have a bad conscience when energy is consumed unnecessarily in the household (e.g., leave lights on in unused rooms) Cronbach's α = 0.766	4.22	1.12
General energy-related attitudes		
Basic convictions (4 items) • Energy conservation is important to me. • I intend to reduce/to further reduce my energy consumption. • Energy conservation goes without saying since I was brought up accordingly. • I pay attention to energy consumption because I care for the future of my next generation. Cronbach's α = 0.866	4.39	0.98
Loss of comfort (1 item) • To me, energy-saving behaviour in the housing domain entails losses of comfort that are too high.	2.92	1.27

Table 7 Study 2: Hierarchical linear regression analysis for variables predicting willingness to reduce heating settings at home ($N = 508$)

	Model 1					**Model 2**				
Predictor variable	*B*	*SE B*	*β*	*t*-value	Sig.	*B*	*SE B*	*β*	*t*-value	Sig.
Constant	1.221	0.278		4.396	**.001*** **	1.235	0.282		4.371	**<.001*** **
Gender (0: male; 1: female)	-0.229	0.113	-.090	-2.021	**.044***	-0.241	0.114	-.094	-2.121	**.034***
Personal Efficacy	0.011	0.063	.009	0.170	.865	0.011	0.063	.009	0.169	.866
Personal Norms	0.170	0.084	.149	2.022	**.044***	0.162	0.084	.142	1.930	.054
Basic convictions	0.109	0.098	.083	1.112	.266	0.122	0.098	.094	1.250	**.**212
Billing type (reference: bill based on actual consumption)										
Bill based on a flat rate per square meter						-0.183	0.130	-.063	-1.407	.160
Billing type not known						0.097	0.183	.024	0.528	.597
Sig. of ANOVA	**<.001*** **						**<.001*** **			
R^2	.051						.056			
R^2 *for change*							.005			
F change	6.810						1.337			
Sig. F Change	**<.001*** **						.264			

*p < .05, **p < .01, ***p < .001.

Table 8 Study 2: Hierarchical linear regression analysis for variables predicting willingness to conserve energy for heating and warm water purposes (N =508)

	Model 1					**Model 2**				
Predictor variable	*B*	*SE B*	*β*	*t*-value	Sig.	*B*	*SE B*	*β*	*t*-value	Sig.
Constant	1.798	0.202		8.888	**<.001*****	1.771	0.205		8.643	**<.001*****
Gender (0: male; 1: female)	-0.014	0.062	-.010	-0.233	.816	-0.008	0.062	-.005	-0.127	.899
Income (reference: CHF 5001-7000)										
Below CHF 5000	0.096	0.092	.056	1.043	.297	0.089	0.092	.051	0.965	.335
CHF 7001-9000	-0.036	0.107	-.017	-0.342	.733	-0.037	0.107	-.017	-0.350	.727
Above CHF 9000	-0.071	0.095	-.039	-0.748	.455	-0.069	0.095	-.037	-0.724	.470
Not indicated	-0.048	0.096	-.026	-0.507	.612	-0.056	0.096	-.030	-0.586	.558
Self Efficacy	-0.046	0.031	-.071	-1.499	.134	-0.041	0.031	-.064	-1.333	.183
Personal Efficacy	-0.005	0.037	-.007	-0.139	.890	-0.005	0.037	-.007	-0.136	.892
Personal Norms	0.151	0.045	.224	3.360	**.001****	0.154	0.045	.228	3.426	**.001****
Basic convictions	0.180	0.053	.234	3.388	**.001****	0.173	0.053	.224	3.232	**.001****
Loss of comfort	-0.098	0.025	-.164	-3.990	**<.001*****	-0.100	0.025	-.167	-4.050	**<.001*****
Billing type (reference: bill based on actual consumption)										
Bill based on a flat rate per square meter						0.101	0.070	.059	1.455	.146
Billing type not known						0.051	0.099	.021	0.512	.609
Sig. of ANOVA	**<.001*****						**<.001*****			
R^2	.236						.239			
R^2 *for change*							.003			
F change	15.365						1.078			
Sig. F Change	**<.001*****						.341			

*p < .05, **p < .01, ***p < .001.