Behavioural insights to change energy consumption patterns of urban households in Pristina, Kosovo

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October 2021

Published by
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

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Bonn and Eschborn, Germany

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1. Background

Kosovo currently ranks among the five most inefficient countries in terms of energy consumption in Europe. Almost 40% of the total energy is used by the poorly insulated household sector, which consumes three times more energy per square meter compared to the EU-wide average. At the same time, energy poverty is prevalent. Lower income families spend up to 20% of their annual income on electricity (Kosovo constraints analyses, MCC). Although the national tariff setting is flexible and allows cheaper electricity usage at night, households are not sufficiently aware of the environmental and economic benefits this entails. Further, many clients still review their electricity bills offline and do not access an offered online portal by the distributors which provides detailed information on the customers' consumption patterns.

Behavioural approaches may help to improve energy-related behaviours such as to promote energy conservation and peak-shaving. Depending on the behavioural bottlenecks, they might suggest small, subtle and cost-efficient interventions, leading to cost-savings for households, the utility provider and to an overall reduction in energy consumption in Kosovo. Yet, behavioural approaches need evidence-based strategies that respect the principles of understanding the context: testing interventions, learning and adaption through the use of rigorous evaluations are the base of the methodological approach.

Behaviourally informed interventions represent an innovative approach to promote energy efficiency for private households. They can embody the social, psychological and economic factors that affect how people think and act, aiming to identify efficiency gains given an existing bureaucratic and technological environment. Behavioural interventions are easily replicable and scalable, stimulating a process of adaptive learning.

The German government is supporting Kosovo institutions through GIZ to conduct necessary mitigation measures and reforms in order to reduce their carbon impact. Mitigating carbon emissions from households' electricity consumption is one of the main challenges. The focus of the Kosovo Energy Project is one specific target area that can profit from behavioural science: Changing domestic electricity consumption patterns.

The following report summarises the results of the project conducted in Pristina with the aim of changing consumption patterns by applying behavioural insight elements. The work was conducted in collaboration between GIZ, the local utility KEDS/KESCO, the consulting firm decision-context and the German Development Institute / Deutsches Institut für Entwicklungsprojekt (DIE).

2. Conceptual underpinnings and project summary

To be successful, behavioural approaches need insights into the „behavioural micro-context". In other words, one needs to understand who should ideally perform which behaviour at what time. Furthermore, insights into why these target behaviours are not exercised already are required. Only if this is the case, interventions that have the prospect of meaningfully increasing the rate of target behaviours can be designed.

To this end, the project has three main components. First, it elaborates on the desired behaviours of electricity consumers. Second, based on this understanding, a survey is designed to comprehend consumers' motivators and barriers for the target behaviours and, more generally, their interests in energy saving behaviour. Third, results serve as a basis for the development of an intervention whose implementation is considered feasible within the constraints of the existing business needs. Concretely, the steps are:

Defining target behaviours. In a series of remote-conferences and meetings[1], a cooperation agreement between KESCO and the Kosovo Energy Project is created. Centrally, this included the definition of target behaviours. These are *a)* a reduction in electricity consumption by lowering room temperatures, *b)* a load shift to the night tariff based on water heating appliances and *c)* an increase in timely payment of open electricity bills.

A. **Identify behavioural motivators and barriers.** Based on expert interviews and psychological theorizing, a survey is designed to assess which factors may be predictive, positively or negatively, for the target behaviours. The results are outlined in Chapter 3 and suggests entry points for interventions.
B. **Testing behavioural interventions.** Based on identifying and understanding the behavioural micro-context of the electricity consumption patterns, a set of interventions is developed. These consist of informative, motivational flyers that are distributed alongside the electricity bills. The conceptual design of a randomized controlled intervention, respecting logistical constraints, is developed. The trial was completed in June 2021[2].

3. Household Survey

To identify and understand energy consumption patterns in Kosovo prior to the project intervention, a baseline household survey has been designed, carried out and is analysed in the following. The survey has been carried out in cooperation with the Pristina-based firm UBO Consulting, to ensure the observance of survey methods, standard methods, and monitoring.[3]

The survey aims at understanding consumer motivation and consumer behaviour related to energy consumption patterns. Special focus was given to the socioeconomic characteristics, attitude and the social influences of the respondents.

The questionnaire was developed in English by the consultants Sascha Kuhn and Florian Kutzner in cooperation with Kosovo Energy Project. Subsequently, it was translated to Albanian and Serbian and migrated to KoBoToolbox by UBO Consulting. Prior to the data collection, UBO furthermore carried out pilot testing of the questionnaire and enumerator training. The data collection took place in October 2020 in five municipalities throughout Kosovo (Pristina, Fushe Kosove, Obiliq, Gllogoc and Podujeve). A technical report, summarizing the survey execution, was provided by UBO Consulting.

[1] Events were initially planned in situ but were delayed and held digital due to the COVID-19 pandemic.
[2] Initially, the completion of the trial was planned before the end of the project. Delays were due to the COVID-19 pandemic.
[3] This has become vital since, due to the COVID-19 pandemic, DIE-initiated travels to Kosovo have not been an option.

3.1. Method and sample

The survey addressed factors that can be expected to predict the three target behaviours. For a reduction in electricity consumption by lowering room temperatures, comfort and social factors were in focus. For load shifting behaviours based on water-heating appliances, efficacy beliefs about the purpose and the ability to do the behaviour were considered most relevant. For timely payment, trust in involved organisations was predicted to be a key element. In addition, we made sure to assess demographic variables, including energy-related ones, the financial status and trust in various official institutions.

The sample was chosen based on geographical areas that were agreed with KEDS/KESO to conduct the intervention. These mainly urban areas consisting of mainly detached housing were chosen because they were considered to offer the largest potential for a reduction in energy consumption.

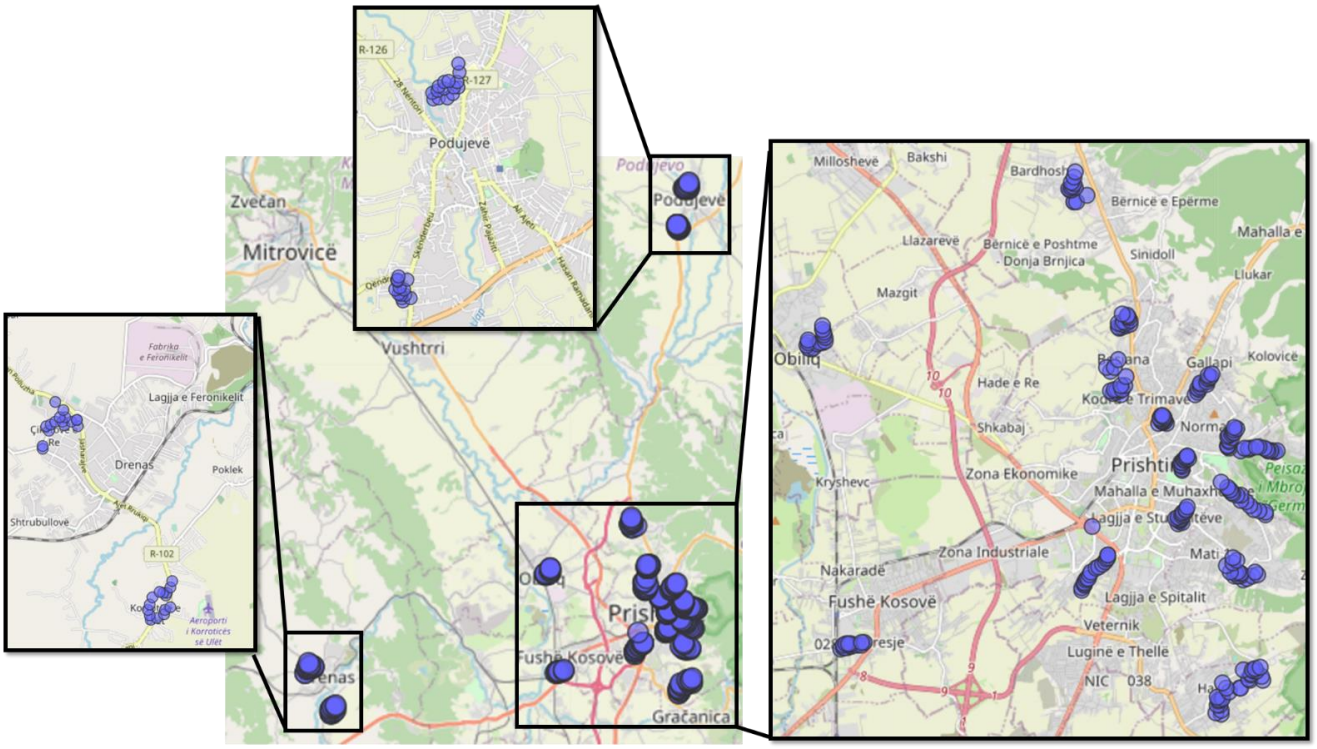

Figure 1: Map illustrating the sampling locations of the base-line survey. 17% of them are from rural regions and 83% from urban regions.

Survey Starting Points (SSPs) were chosen within the selected areas and enumerators were instructed to follow a random walk. In total 20 SSPs were chosen with the aim to collect at least 15 responses per SSP. The random walk incorporates the instruction to survey every 5th house starting from the SSP. In case of non-responsiveness, the enumerator was asked to survey the next house on the street closest to the survey point.

The final sample of respondents consist of 301 respondents. Around 83% of the respondents live in urban areas. Specifically, responses were collected from the following districts: Bardhosh (N=15), Bislim Makolli (N=6), Bledi (N=14), Bregu i diellit (N=15), Gllogoc (N=16), Emshir (N=14), Fushë Kosovë (N=15), Hajvali (N=27), Kalabri (N=3), Kolovice (N=30), Koretice (N=11), Matiqan (N=32), Obiliq (N=15), Podujevë (N=28), Prishtine (N=16), Sofali (N=9), Velani (N=15), Vranjevc (N=15) and Xhevdet Sinani (N=4).

3.2. Survey Results

3.2.1. Sample Demographics

Most surveyed households consisted of four or more people, only 8.7% of households were single households. The median room number of the apartments / houses of surveyed participants was 6, however spreading from a minimum of two to a maximum of 15 rooms. The moving frequency seemed to be limited among the survey participants: On average, the surveyed individuals have lived under the current address for 23.7 years (given a median age of 34 years / mean age of 37 years, cf. Figure 2).

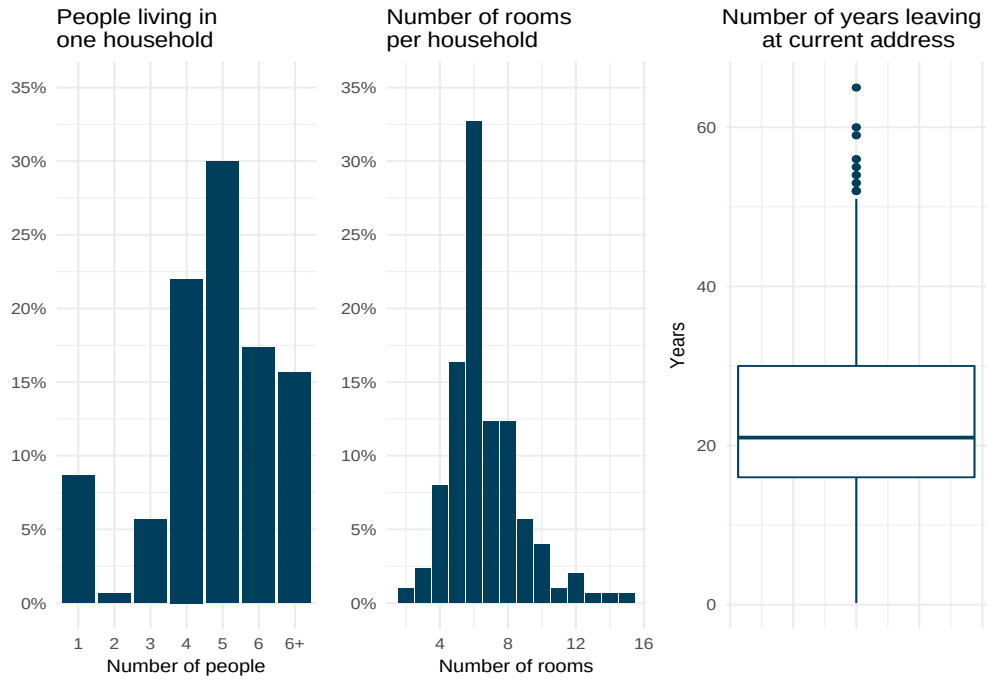

Figure 2: Density plots and a box-plot on household characteristics.

More male than female people were surveyed (35% v. 65%). Furthermore, the age distribution function peaks at 20-24 years for female participants (mean age 36 years), and at 30-34 years for male participants (mean age 38 years). However, median age was 34 years for both groups which is slightly higher than the median age of the whole population of Kosovo (30.5 years[4]). Most surveyed people did hold at least a high school degree and were currently employed.

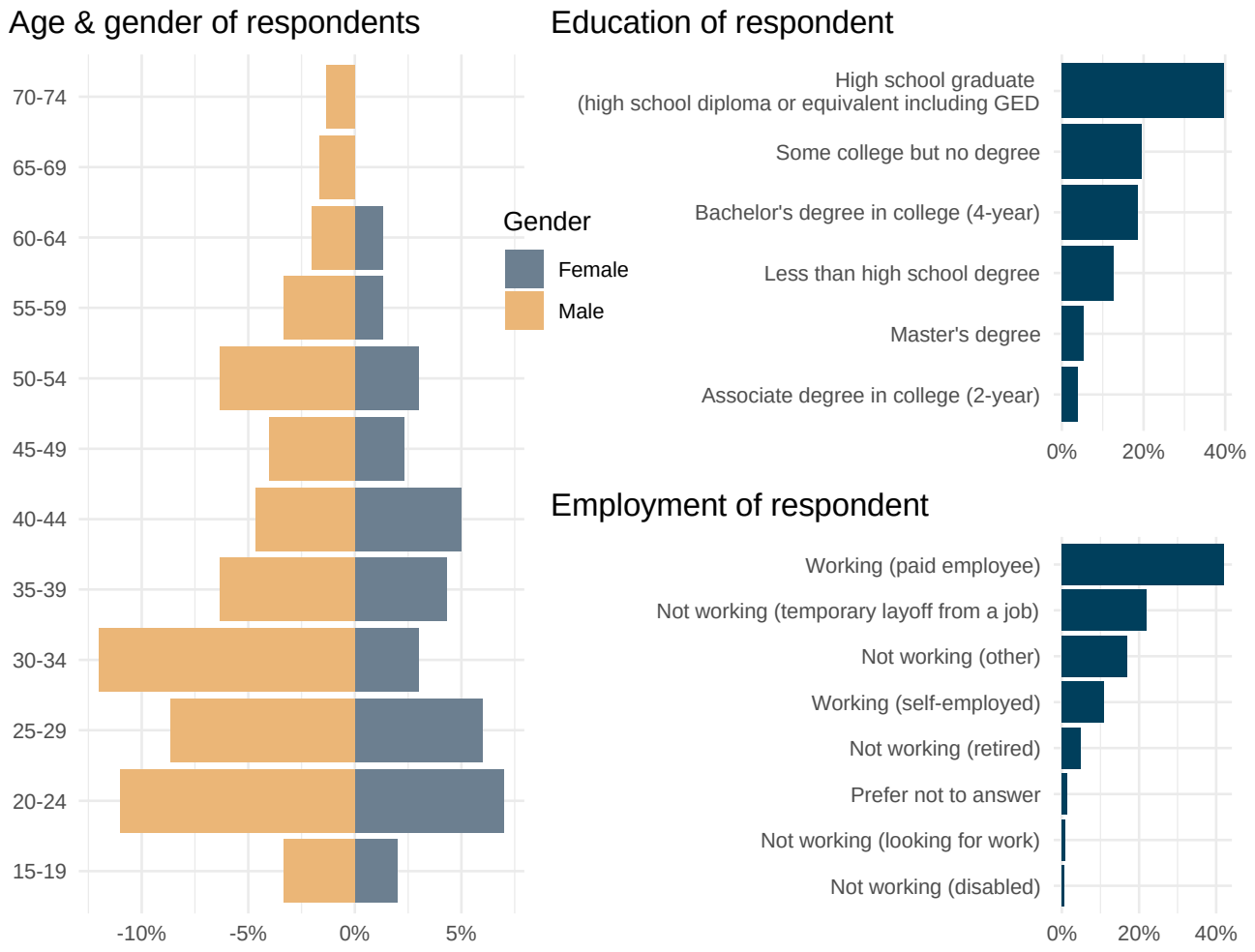

Figure 3: Demographics of respondents.

[4] Central Intelligence Agency (2020): The World Factbook.

Regarding income, at least 50% of the surveyed households earned less than 5,000€ a year (previous year after taxes, cf. Figure 4) Roughly 20% of survey participants didn't give a clear answer. In addition, as is visible from the questions on the financial situation (cf. Figure 5), at least 75% of households faced financial constraints throughout their everyday life and roughly 50 % of households were potentially struggling with unanticipated financial expenses in the range of 300 – 700 €.

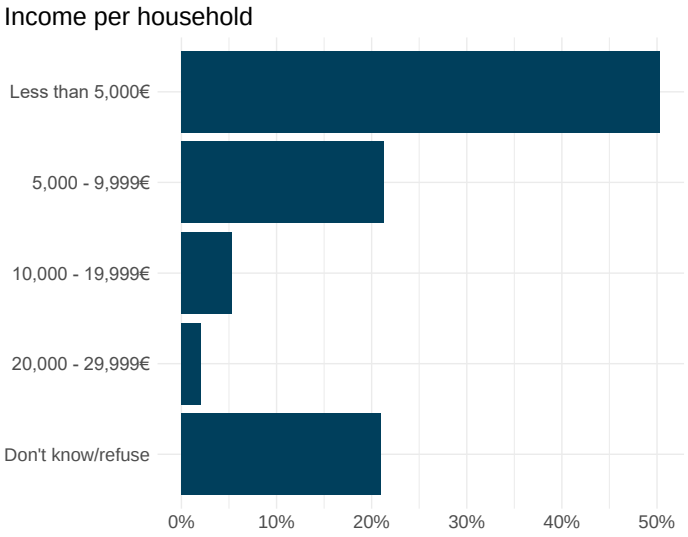

Figure 4: Income of households (previous year after taxes).

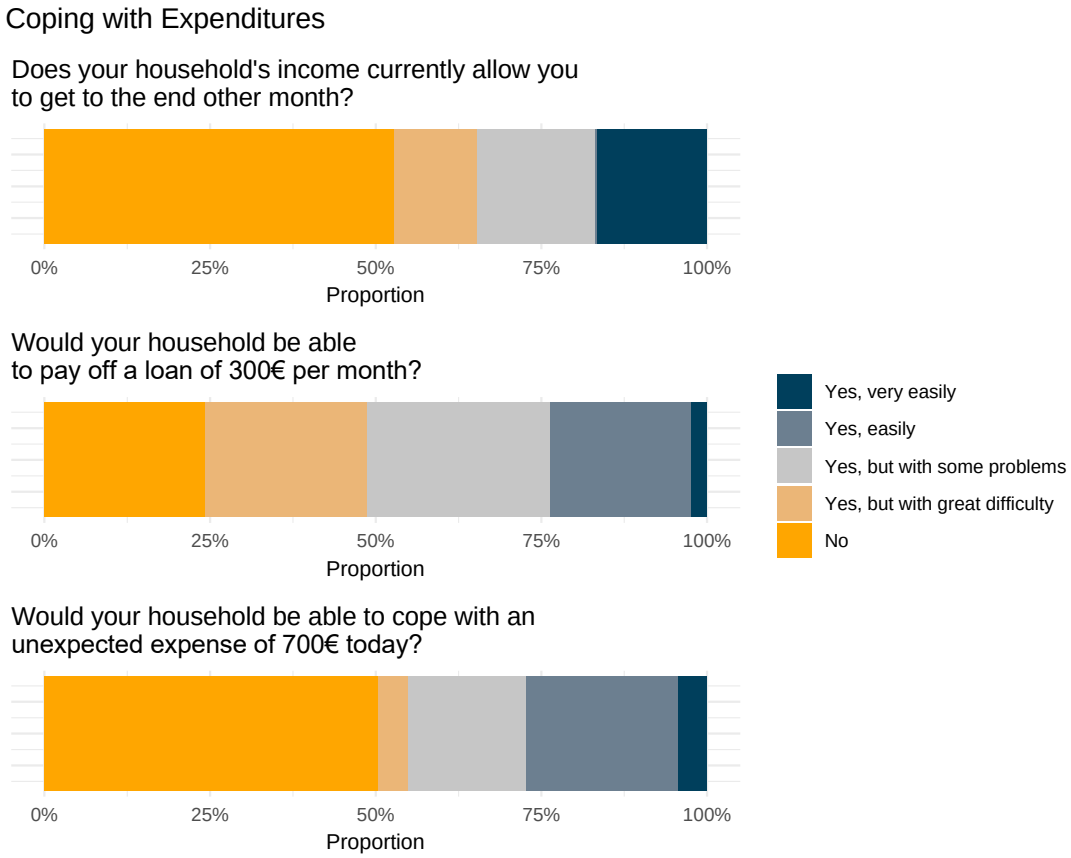

Figure 5: Coping with expenditures.

Overall satisfaction of the respondents with public Kosovan services and utilities like the local roads and schools, electricity and water supply and medical care was relatively high, although many neutral opinions are present, cf. Figure 6. Satisfaction with local schools was seen least homogeneously.

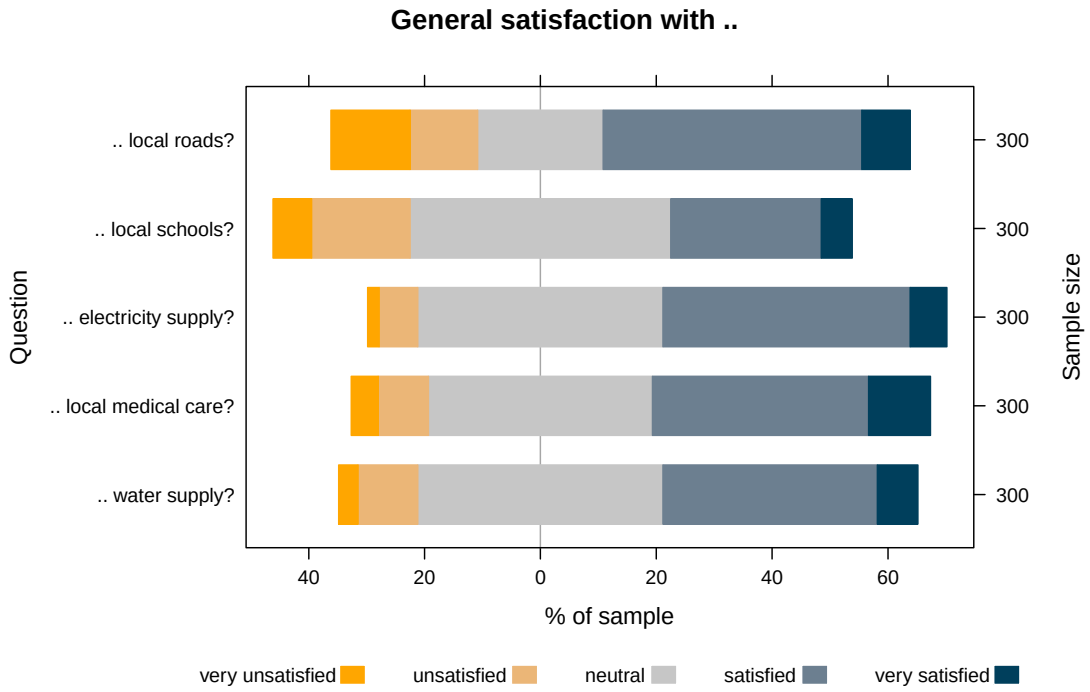

Figure 6: General satisfaction with public utilities.

General trust in politicians and legal support is critical in Kosovo: Nearly 62% of the surveyed persons indicated to distrust politicians in general, whereof 80% even indicated to strongly distrust them. 41% of the sample distrusted the legal system, while 25% distrusted the media and electricity supply respectively, cf. Figure 7. Against this generally low level of trust, utilities fared relatively well. This is important, given any intervention that requires consumers' cooperation will require a certain level of trust.

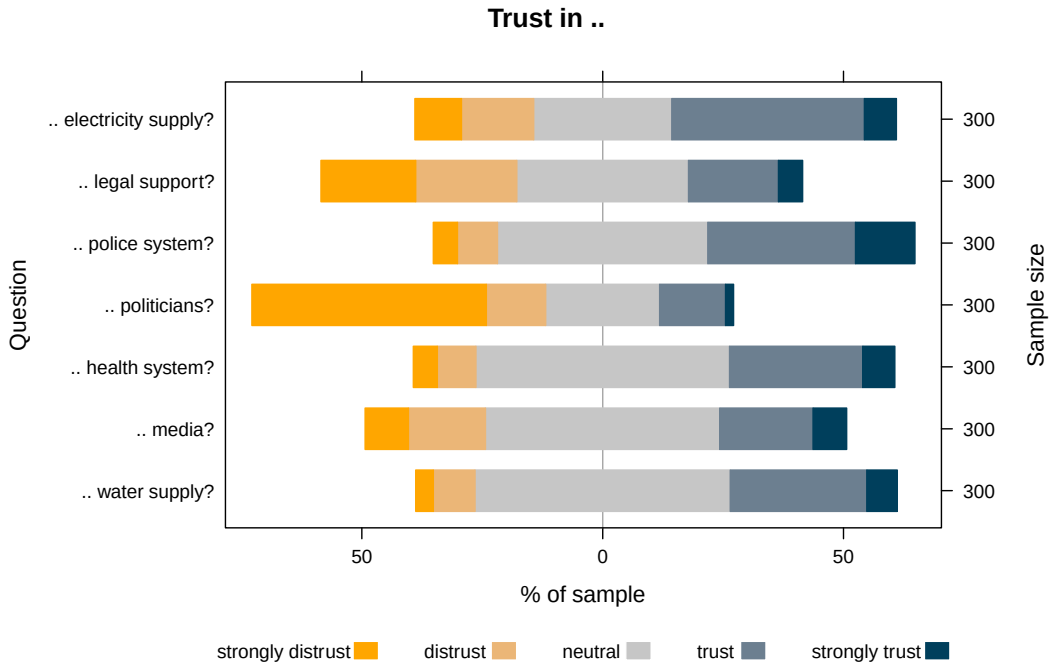

Figure 7: General trust in public utilities and persona.

4. Energy Demographics

This section illustrates the energy related “demographics” including assets ownership, efficiency enhancing assets, and energy sources and consumption habits for heating. These serve as the backdrop against which interventions can be conceived.

Figure depicts the ownership of electric appliances per household within the sample. Thermos, dryers, air conditioners and microwaves are the appliances that were least commonly owned. Most household do not even own any of those devices. Fridges, TVs, water heaters, laundry machine, ovens and stoves are owned by nearly every household. Waterheaters, TVs, computers, fridges and stoves are assets that are owned more than once by some households. On average households own 1.55 stoves, 1.47 waterheater, 1.36 TVs, 1.10 refrigerators. 1.03 ovens, 0.99 laundry machines, 0.9 computers, 0.62 dishwashers, 0.48 microwaves, 0.30 air conditioners, 0.25 laundry dryers and 0.05 thermos.

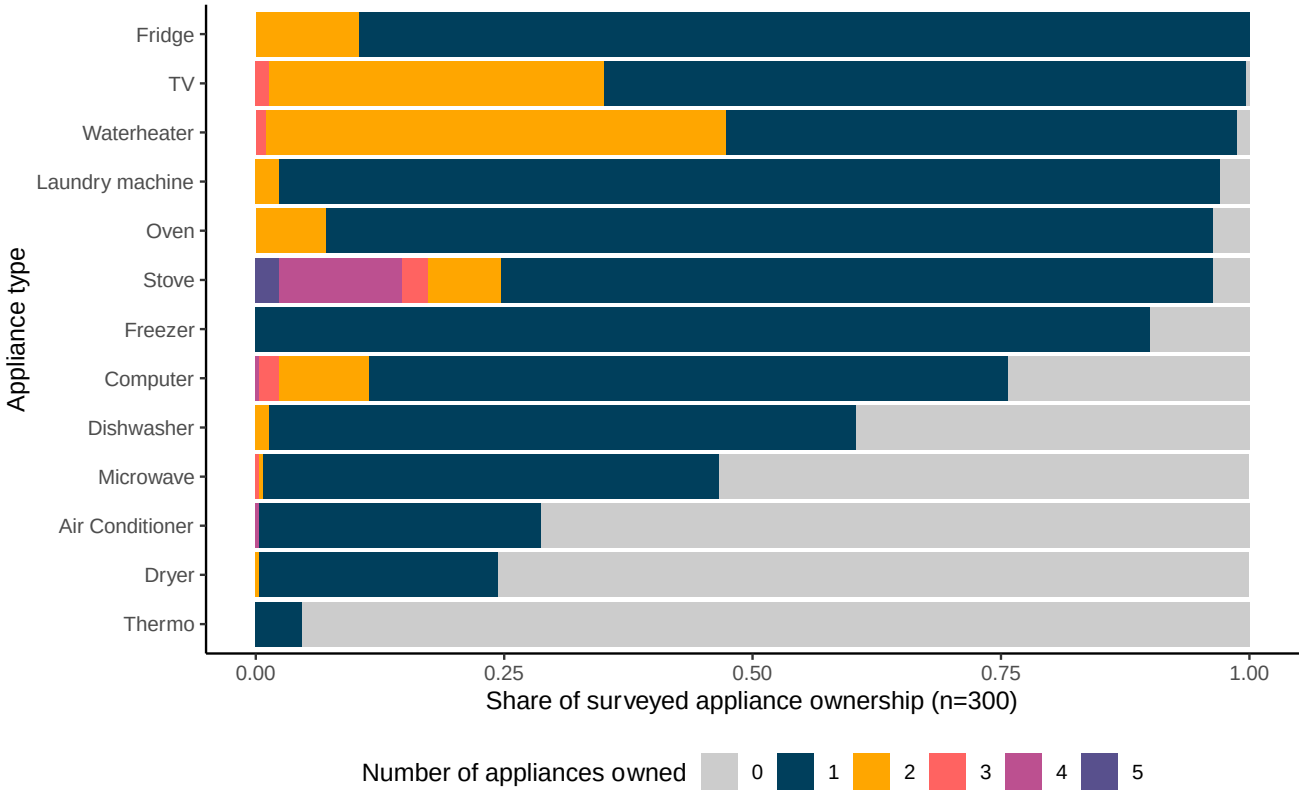

Figure 8: Appliance ownership.

On average, surveyed households owned about 12 light sources. Most light sources were allocated to the living room, cf. Figure 8. According to respondents' self-report, 70.7% of light sources in use were energy efficient.

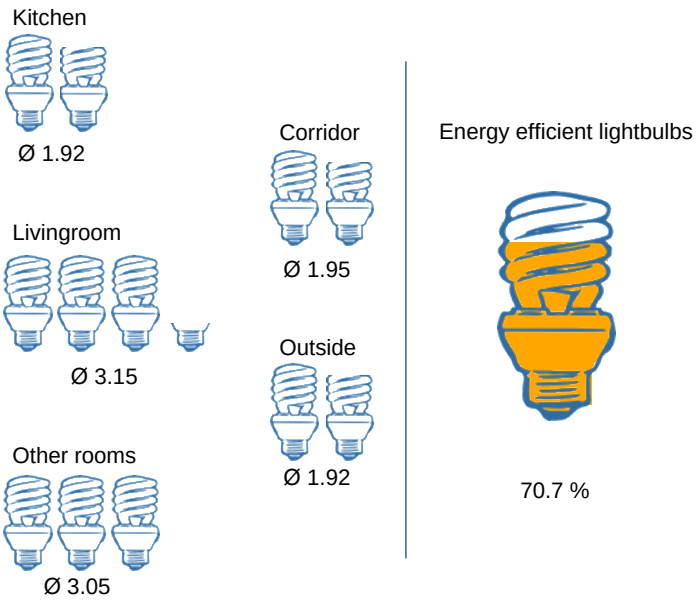

Figure 8: Illustration of lighting devices by rooms and efficiency.

Ownership of energy efficiency enhancing assets was mixed, cf. Figure 9: Roughly 63 % of surveyed households lived in an insulated dwelling, however only 18% of all households' dwellings had three layered windows built in. KESCO offers an App to their customers that allows them to track their consumption and pay their energy bills. The eKESCO App was only rarely owned and used, only 8% of respondents indicated to do so. Only 2.6% of the sample indicated to own and use a timer for their devices. However, interestingly, over half of the sample were not aware of the fact if they owned and used a timer for their devices. Increasing the percentage of people who use the eKESCO App as well as a timer through a behavioural intervention would be a leverage point to change energy consumption.

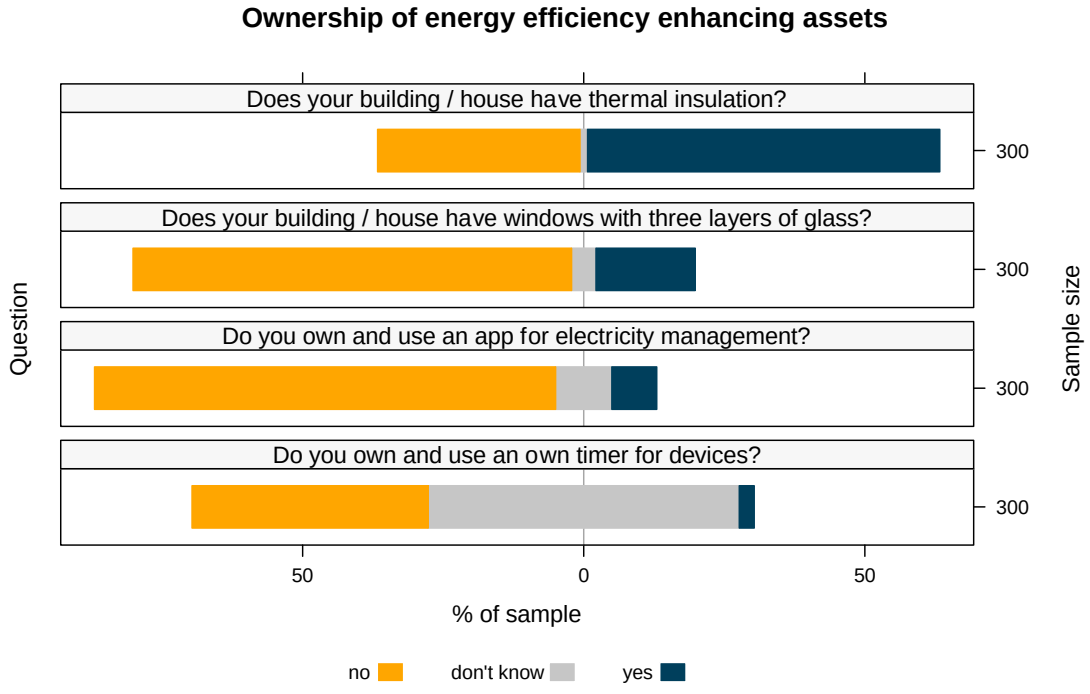

Figure 9: Ownership of energy efficiency enhancing assets.

In general, a large share of energy is used to heat water. In the sample 90% of those households who are aware of their water temperature setting (excl. “don’t know” answers) set their water heater to a hot or the hottest temperature setting (cf. Figure10)

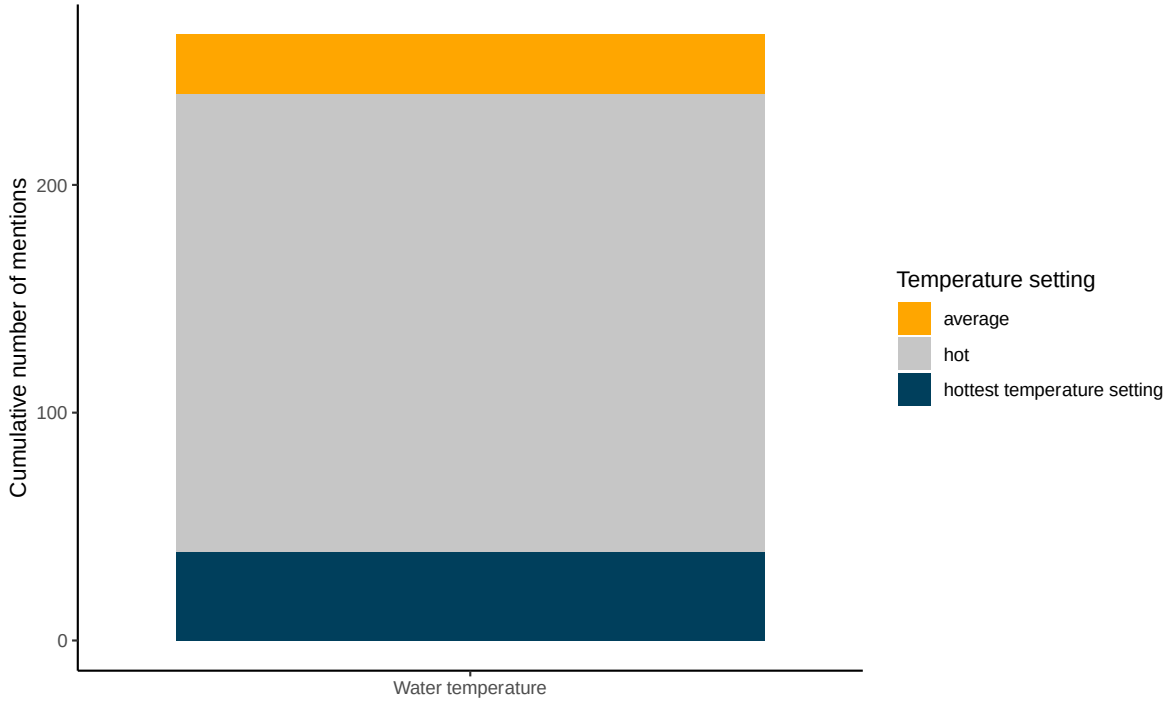

Figure 10: Water temperature setting.

On average, surveyed households heat their homes at 22.9°C. However, this varies to a large degree (cf. Figure 11). A small amount of households even heat to over 25°C and some under 20°C. 38% of households have a central heating system (cf. Figure 12).

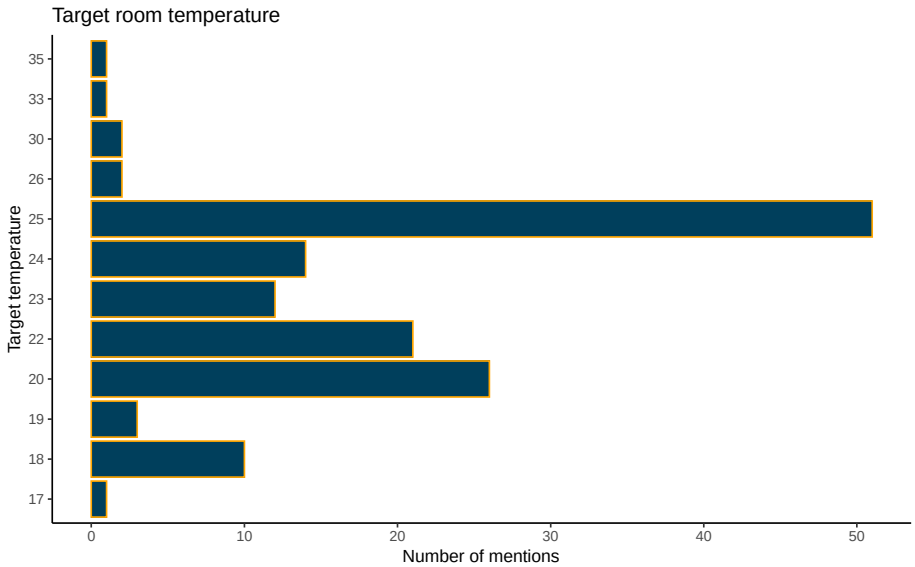

Figure 11: Target room temperature.

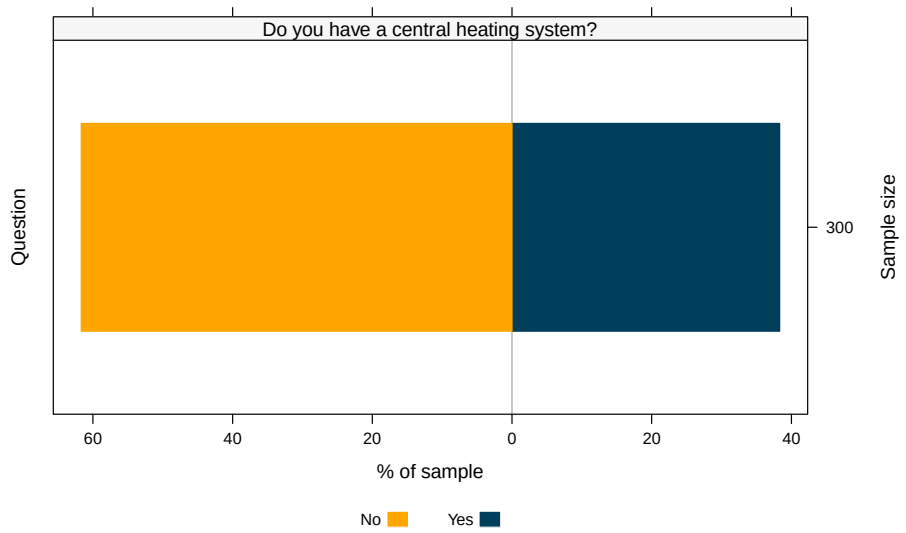

Figure 12: Ownership of central heating system.

Heating for most surveyed households, roughly 72%, was powered by wood, followed by electricity as the second most common heat source (40% of surveyed households use electricity for heating), cf. Figure 14. People living in rural areas tended to heat relatively more often with wood than with electricity. None of the households used oil as a heat source.

Given that many households have to cope with poor insulation, it is unsurprising that most only heated up to 50% of their living space, cf. Figure 13. However, there exists a sizeable group of respondents (roughly 22% of the total sample) that heated their full living space. Thus, a majority seems to be trying to curb energy use for heating while roughly a quarter of respondents did not show any signs of saving behaviours. In addition, 52% of respondents did not know the target room temperature for heating. Of those who do know, respondents reported to heat to a target temperature of 22.9°C (mean) and 25°C(median). Only very rarely, people heated to a target temperature of over 25°C.

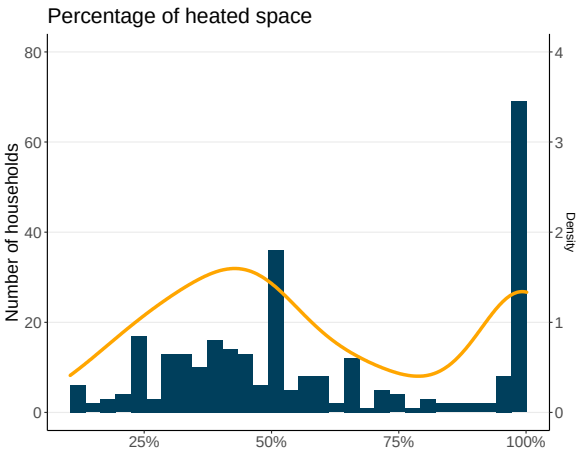

Figure 13: Distribution of share of heated space in total space.

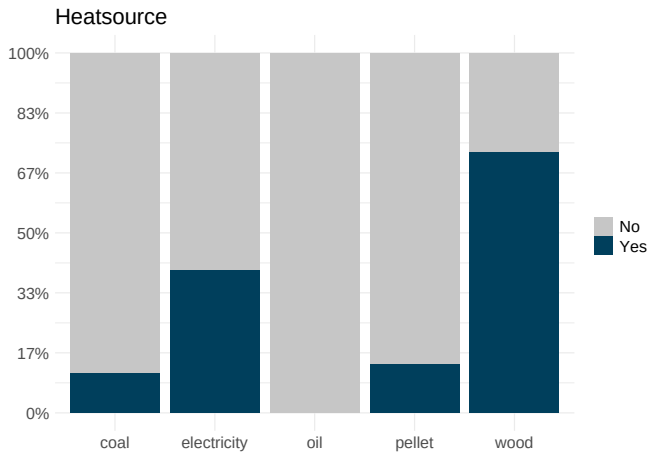

Figure 14: Energy sources for heating.

Furthermore, we asked households how much resources they consumed per year. Households using wood for heating report to use on average 12.64 m³ per year. Households that use coal report to use on average 3.6 tons per year. Whereas households that use pellets report to use on average 3.7 tons per year (cf. Figure 15)

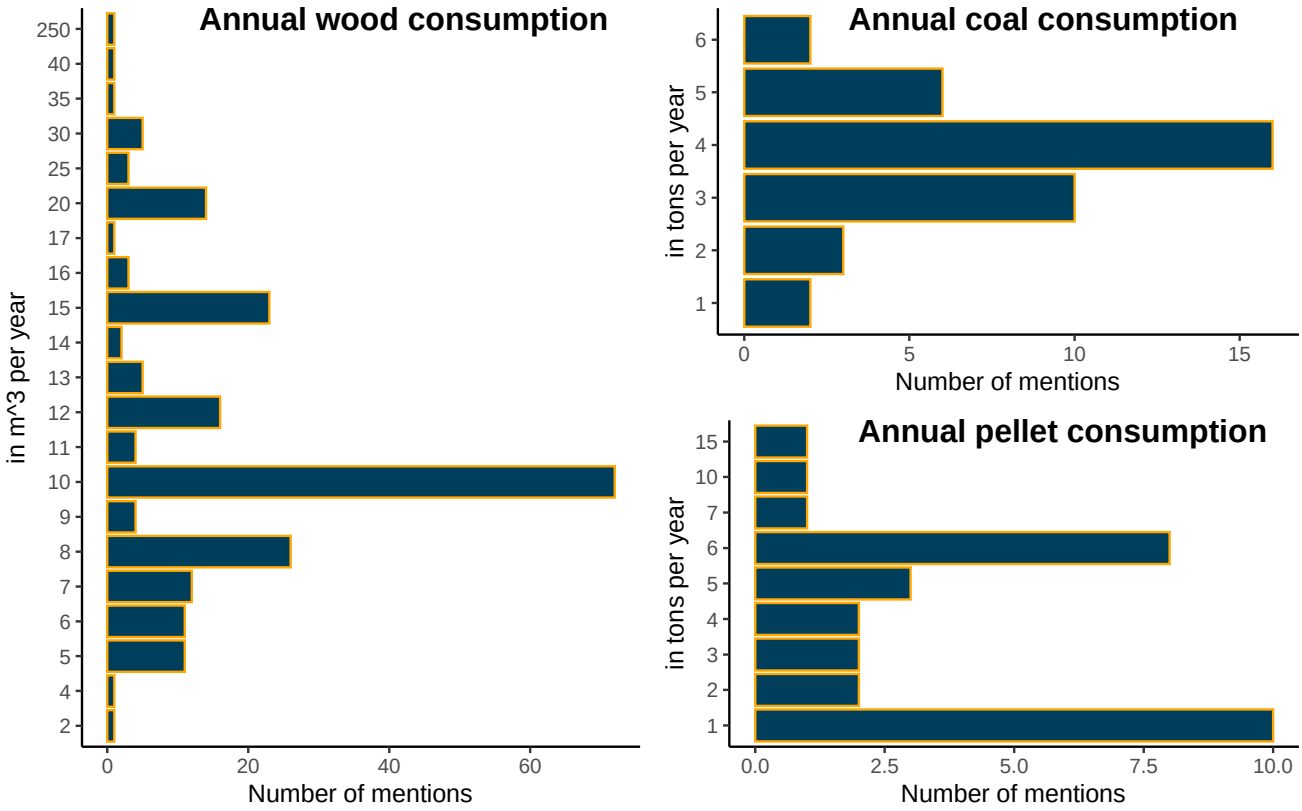

Figure 15: Annual resource consumption for heating.

To control for the size of the respective living space, we also calculated the relative consumption per square meter (cf.

Figure 16; we excluded outliers of relative wood consumption above the 99th percentile). A high peak for wood per total household size speaks for the frequency of households using wood as a secondary source for heating.

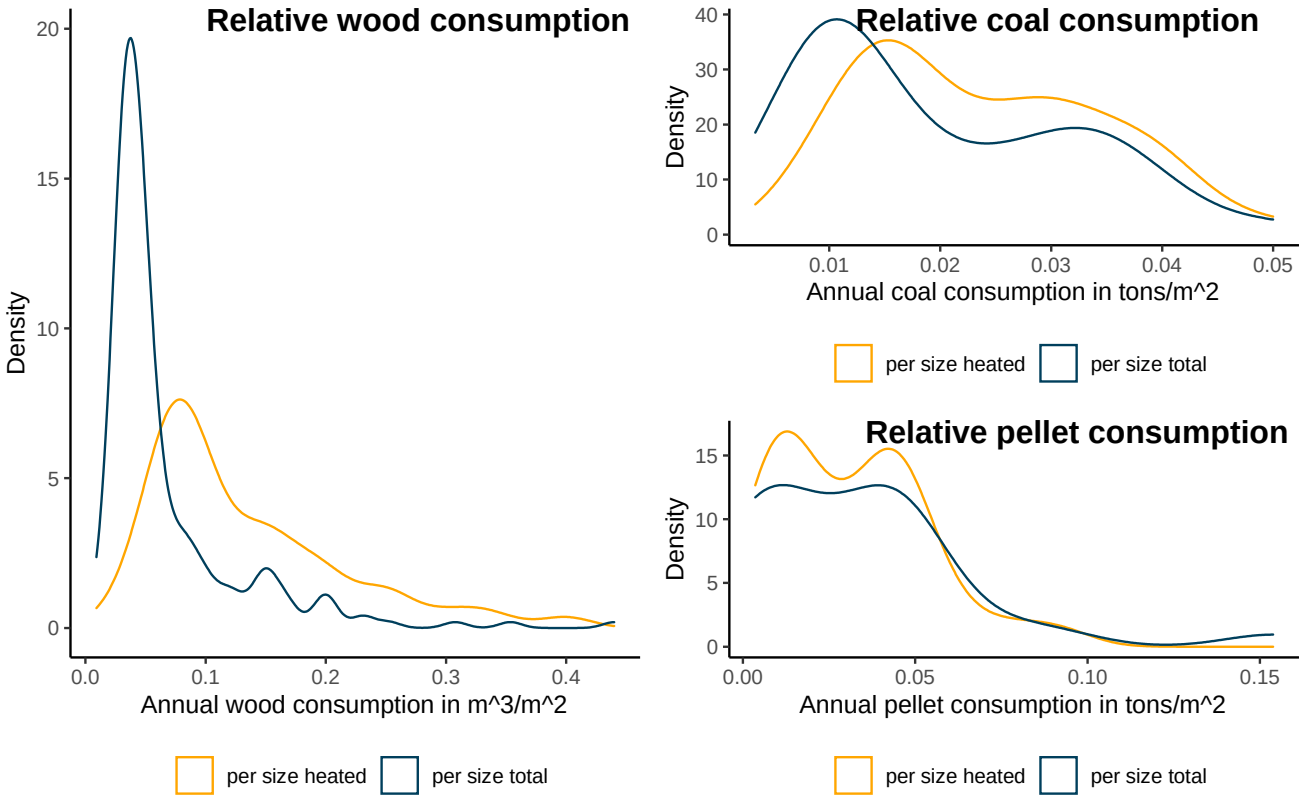

Figure 16: Relative resource consumption per living space.

Most households are connected to a single meter point: Only 5 % of the surveyed households share their meter point with other households. The number of households sharing one meter is used to derive the reported electricity consumption and expenditure per household. On average, households report to have consumed in the last month 60.2 kWh during high tariff and 45.5 kWh during low tariff and a reported average monthly household electricity expenditure of 38 € (cf. Figure 17).

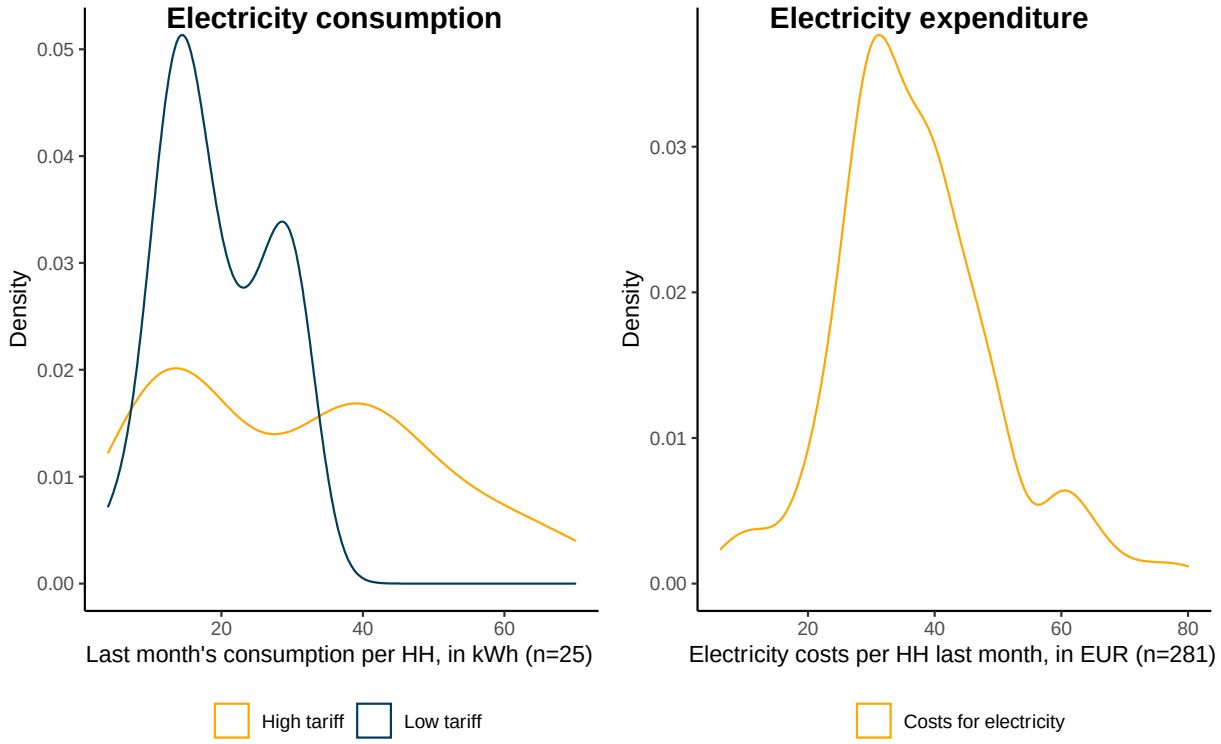

Figure 17: Last month's electricity consumption and expenditure per household.

The variation of low tariff consumption and electricity costs decreases when controlling for the number of household members[5], thus the shape of the density figures becomes more distinct, cf. Figure 18. However, the difference between high and low tariff consumption again is relatively large. During the month prior to the survey, 11.2 kWh have been consumed on average per household member during the high tariff, and 8.6 kWh during the low tariff. The average monthly electricity bill accounted to 10.1 € per household member.

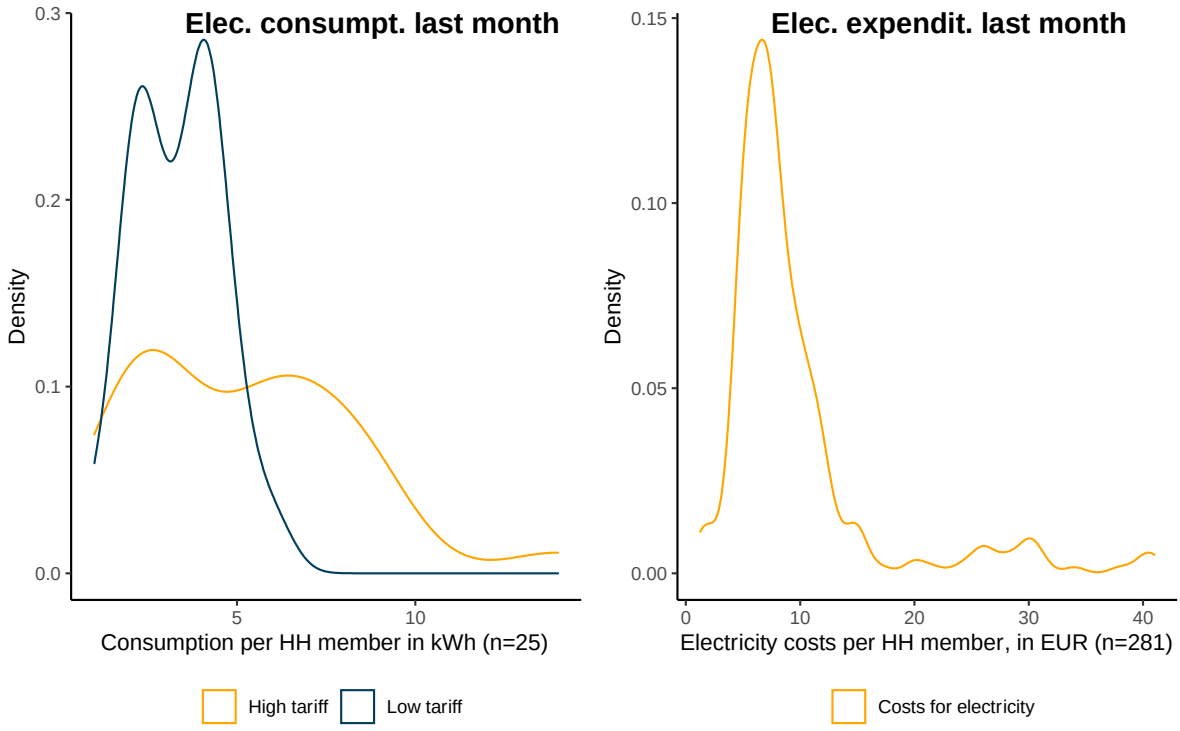

Figure 18: Last month's electricity consumption and expenditure per household member.

4.1.1. Environmental concern and efficacy beliefs

Environmental protection, mainly in terms of reducing greenhouse gas emissions, can be a reason motivating the target behaviours of reducing the room temperature and using the night tariff. To get an understanding of the prevalence of pro-environmental reasons, we assessed environmental concern and environmental efficacy beliefs. Efficacy beliefs represent the conviction that certain behaviours do indeed lead to the intended outcome, here environmental protection and that oneself is able to understand and successfully preform the required behaviours. Both, environmental concern, and efficacy have been shown in scientific studies to predict pro-environmental behaviours.

When asked for the concern for the environment and limit environmentally damaging footprint, a positive picture emerged: 74% of the surveyed persons indicated that it matters to them that their devices used do not harm the environment. Other questions, like considering the environmental impact of one's actions, environmentally friendly habits, concerns about wasting resources and being an environmental

[5] For this calculation, households that indicated to have more than six household members were assumed to have seven household members.

responsible person, was strongly agreed by a similar magnitude of the sample (58% - 65%). Furthermore, 53% of the surveyed participants were willing to restrict themselves to be more environmentally friendly. Thus, willingness for environmentally amicable behaviour was given to a large extent throughout the sample.

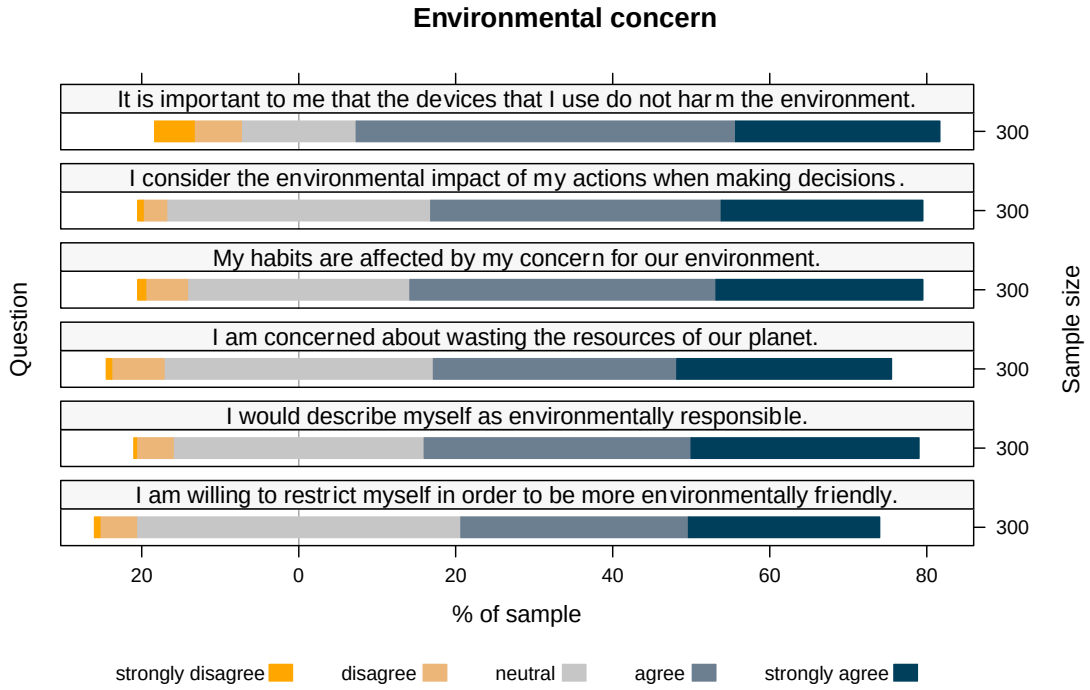

Figure 19: Environmental concern and respective actions.

Regarding the environmental efficacy beliefs, the picture was more mixed (cf. Figure 20): While 58% of participants indicated to have a good or very good knowledge about global climate change and that burning of fossils has a negative impact on the climate, neutral answers ranged from 36% - 47% for questions about the knowledge of electricity-related behaviours. A general awareness of climate change seemed to be given, however, the conviction that energy savings and peak shaving behaviours contribute to protect the environment seemed to be less pronounced.

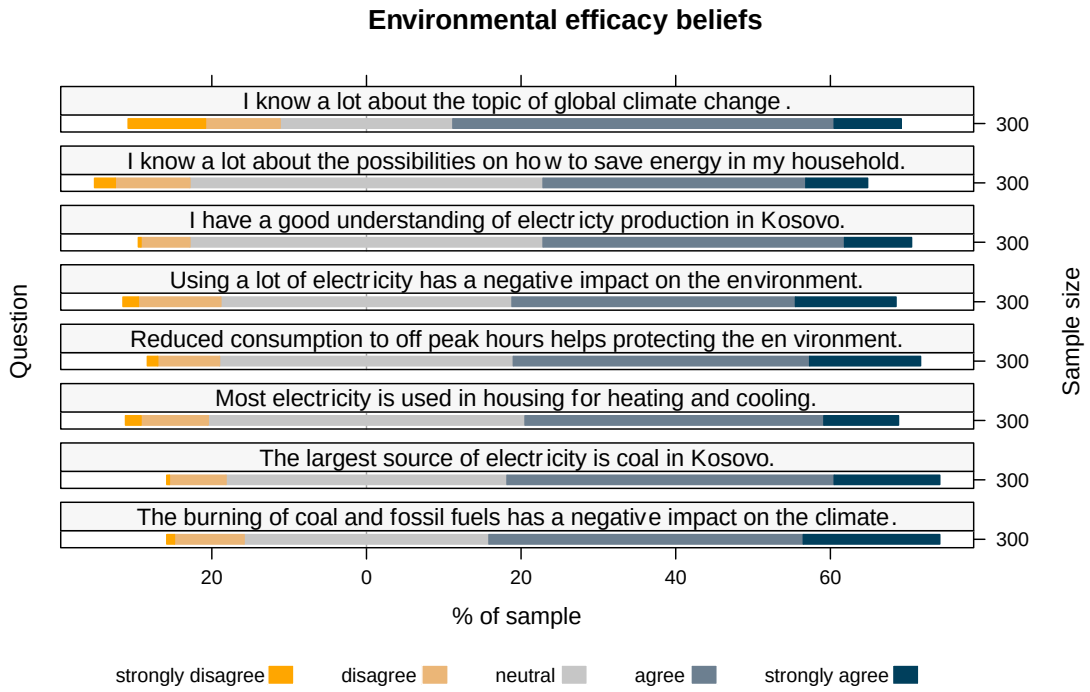

Figure 20: Environmental efficacy beliefs.

4.1.2. Predicting energy saving behaviours

In this section, we report on the prevalence of several energy savings behaviours. This includes one of our target behaviours, reducing the room temperature. More importantly, we also try to predict these behaviours from various theoretically important variables. These include environmental efficacy beliefs and the importance of different reasons that might promote or hinder energy saving behaviours, such as the social network, financial considerations, comfort, or effort.

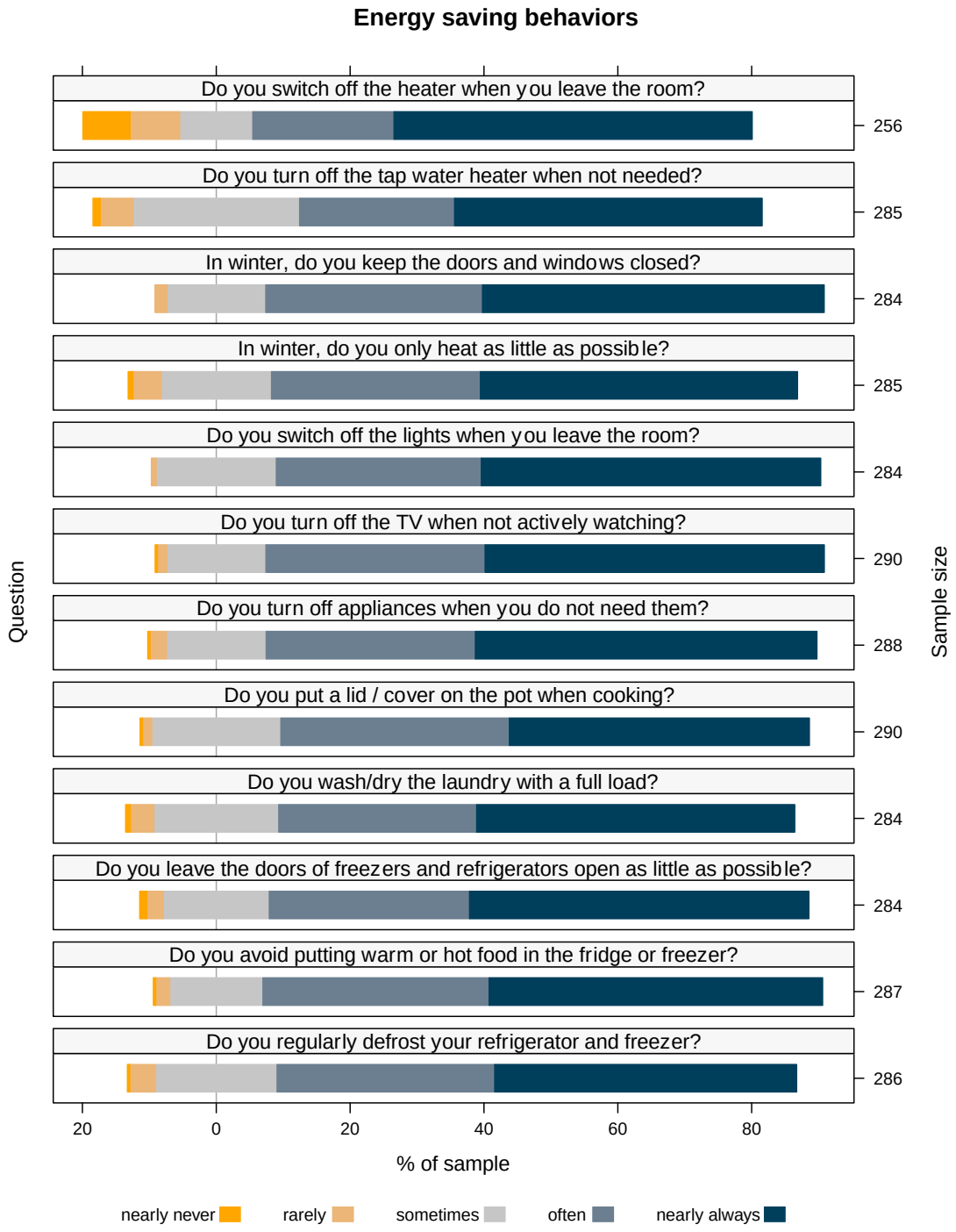

Figure 21: Self-reported energy saving behaviours.

The self-report of specific energy saving behaviours was in line with the more general environmental concerns. Efforts to save savings were already present and practiced by a large share of the surveyed households. 64% of the sample indicated to “often” or “nearly always” switch off the heater when leaving the room, 66% indicated to “often” or “nearly always” turn off the tap water heater when not needed. For other appliances, energy-saving behaviour was even more frequent: roughly 75 - 80% of the sample only heated as little as possible during winters, keep their doors shut when it’s cold outside, take care of switching off lights when leaving the room and turn off their TV when not actively watching, turn off their appliances when not needed and use a lid when cooking (cf. Figure 21).

Further, these self-reported energy saving behaviours were well aligned across respondents. That is, reporting to preform one behaviour usually went along with reporting to perform the other behaviours as well. This allows us to predict a more reliable summary index of energy savings behaviours instead of single behaviours.

Yet, heating behaviours in particular deserved attention on a priori grounds. Heating is one of the largest factors in domestic energy consumption and, in combination with a large share of electric heating systems, is responsible for a large share of greenhouse gas emissions. Thus, we assessed additional possible predictors for heating behaviours. First, we assessed the efficacy beliefs regarding the link between heating behaviours and financial savings (cf. Figure 22). The beliefs reflect that heating less and preventing loss (e.g. by keeping doors closed or having three-layer windows) is considered more effective using low tariffs during the night (see also next section on peak shaving behaviours). The variability of responses overall indicated that efficacy beliefs are a promising avenue for interventions.

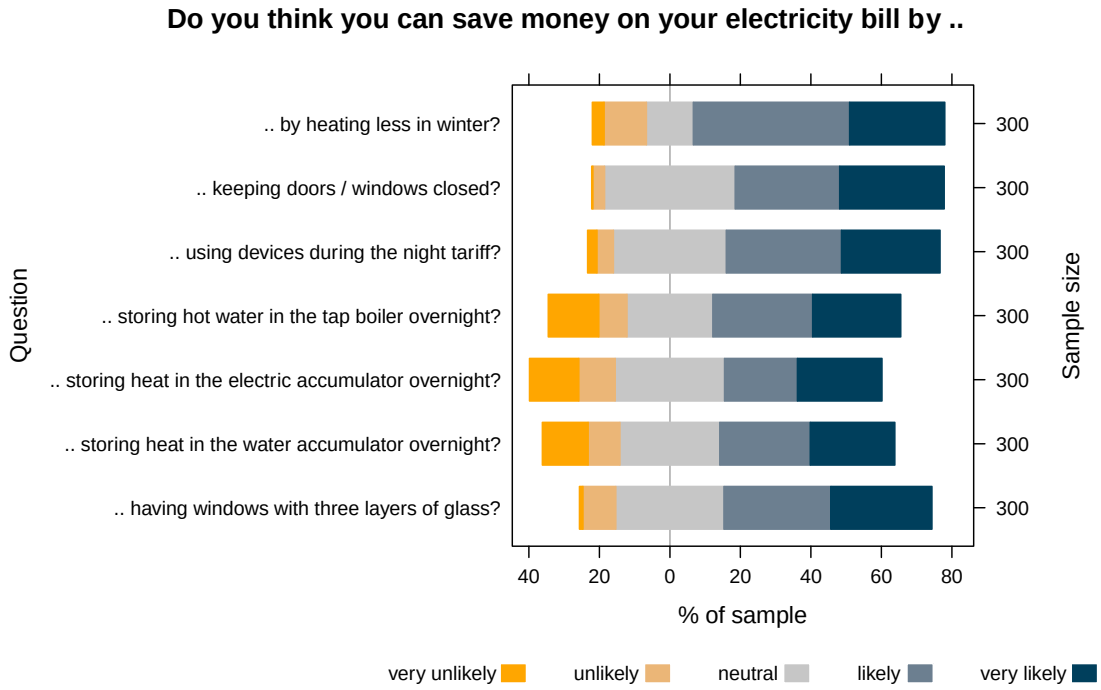

Figure 22: Efficacy beliefs for financial savings of heating behaviours.

An important factor influencing an individual's beliefs about other people's behaviour. We do find that saving behaviours such as heating less, closing windows are believed to be done by most peers, whereas peak shaving behaviours such as storing heat are done less often (cf. Figure 23)

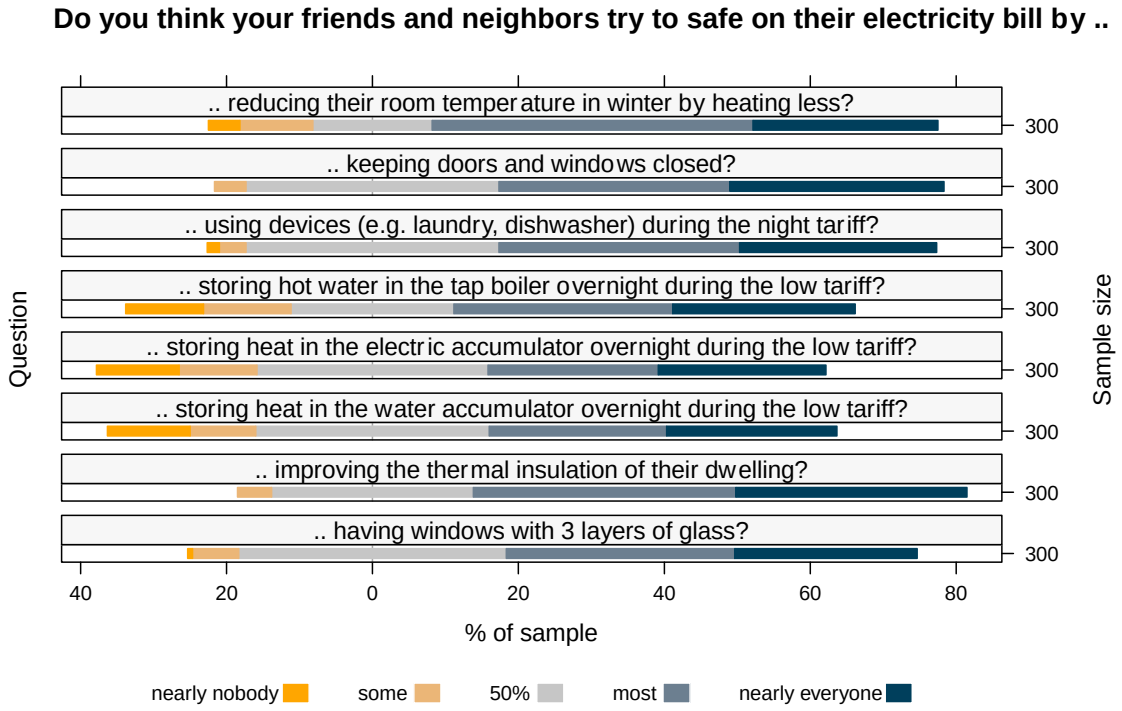

Figure 23: Suspected behaviour of others.

Additionally, we assessed the importance of possible reasons that might promote or prevent one of the identified target behaviours, lowering the room temperature. Since we were interested in singling out potential entry points for an intervention, reasons were not specified as to whether they were promotive or preventive. For example, if the importance of other household members' preferences relates to saving behaviours, interventions targeting social norms would suggest itself. On average, we found the highest importance ratings for the temperature preferences of other household members and the effort involved to change the temperature (cf. Figure 24).

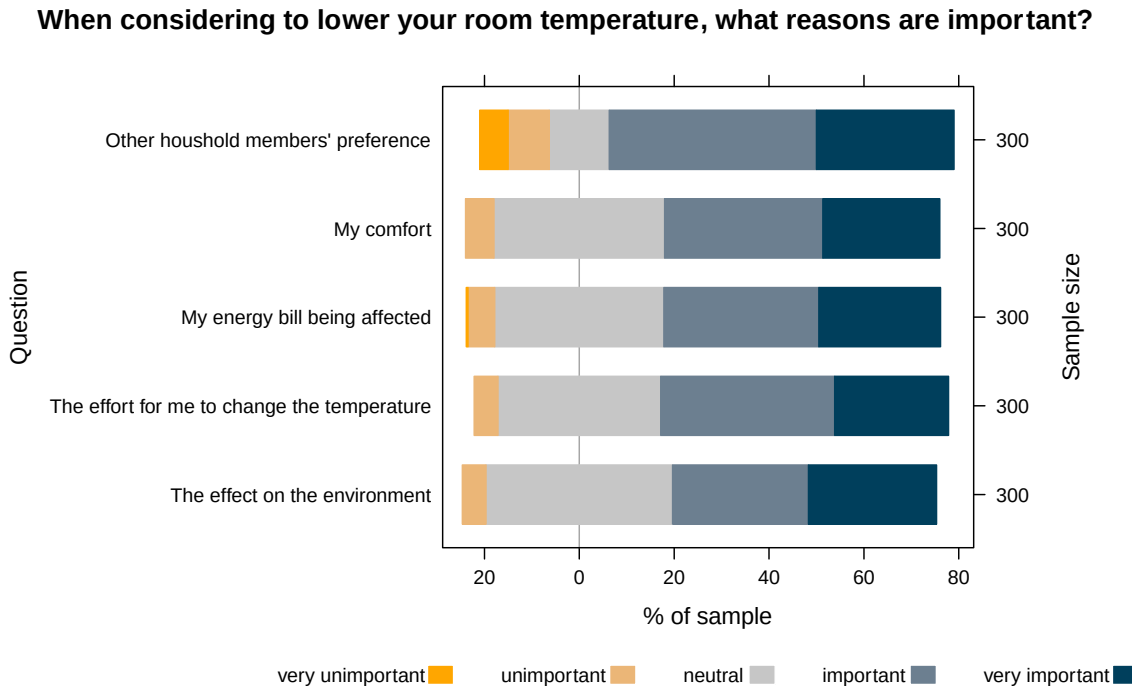

Figure 24: Importance of potential reasons for lowering the room temperature.

Finally, it is important to look beyond the prevalence of behaviours and beliefs to arrive at possible interventions to promote energy savings behaviours. Therefore, we conducted regression analyses the relate behaviours to other variables. Strong and reliable relations are then taken as best guess as to where interventions causally change behaviours. The ultimate demonstration of these causal relations, however, needs to be confirmed by randomized controlled trials.

Based on several regression analyses using least squares modelling, we ended up predicting the summary index of energy saving behaviours, including lowering the room temperature, from three types of efficacy beliefs and importance of specific reasons to lower the room temperature (cf. Figure 24). The efficacy beliefs were the conviction that energy behaviours do contribute to environmental protection (Energy Behaviours – environmental protection), that energy savings behaviours do lead to cost savings (Energy saving – financial saving), and the conviction that peak shaving behaviours lead to cost savings (Peak shaving – financial saving). To be able to generalize better beyond specific household situations, we statistically controlled for the household size, the family size and the financial situation.

Five aspects proved reliable in predicting energy savings behaviours (cf. Figure 25). Respondents more convinced that energy saving behaviours contributes positively to environmental protection and reducing costs, were more likely to engage in them. Further, those rating the importance for lowering the room temperature of family members, effort and environment highly were more likely to engage in energy saving behaviours. Overall, the model explained a fair amount of the variability of energy saving behaviours (R^2 = .65).

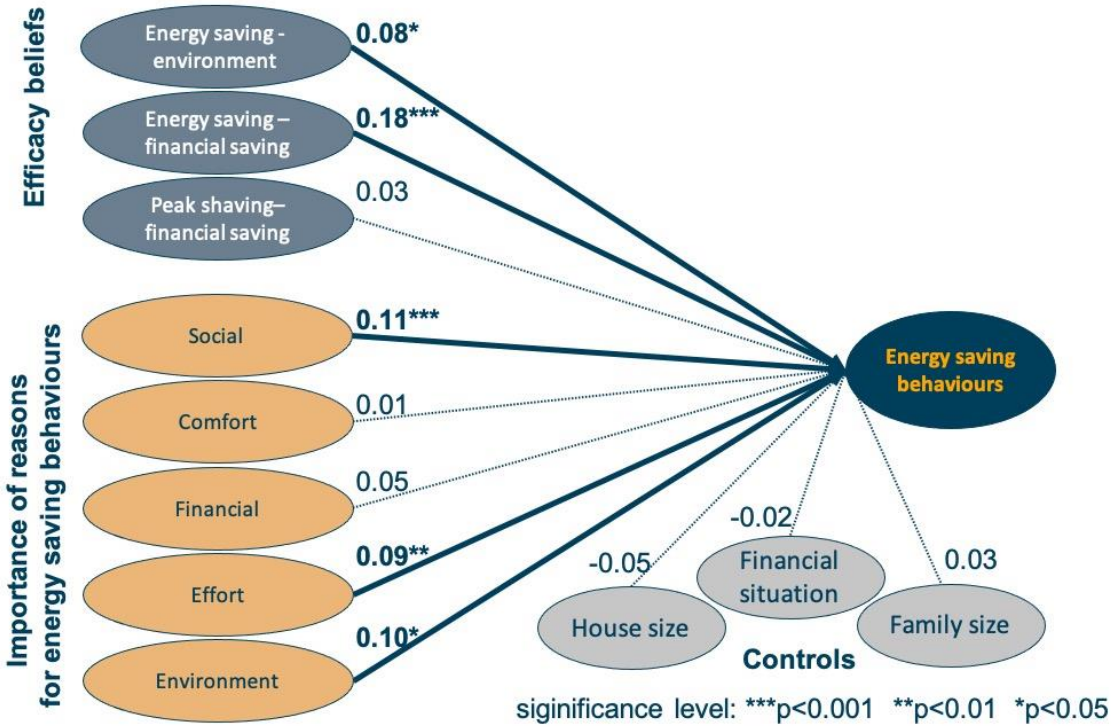

Figure 25: Illustration of the regression model predicting energy saving behaviours. Numbers represent standardized regression coefficients. Reliable predictors are represented by solid lines.

In sum, energy saving behaviours were widely observed in the sample, as are financial and environmental reasons for performing them. Further, the regression analysis suggests that efficacy beliefs and social as well as effort-related aspects might be targeted by interventions. Interventions could involve information about the behaviours' impacts, could target inner-household exchanges on room temperatures or reduce effort for stetting room temperatures, for example by using smart devices.

4.1.3. Predicting peak shaving behaviours

The daytime split electricity tariff aims at lowering peak demand and grid pressure during peak hours and entails a 50% cost saving potential for the Kosovan households. In this section, we report on the knowledge and attitudes about the daytime split tariff and on the prevalence of several peak shaving behaviours. Again, more importantly we also try to predict these behaviours from various theoretically important variables. These include environmental efficacy beliefs and the importance of different reasons that might promote or hinder peak shaving behaviours, such as the social network, financial considerations, comfort, or effort.

The split tariff structure is generally perceived well: When scaling the opinion from 0 to 100, respondents tended to perceive the tariff structure as rather cheap, as transparent, and moderately fair, however with tendencies to unfairness, cf. Figure 26.

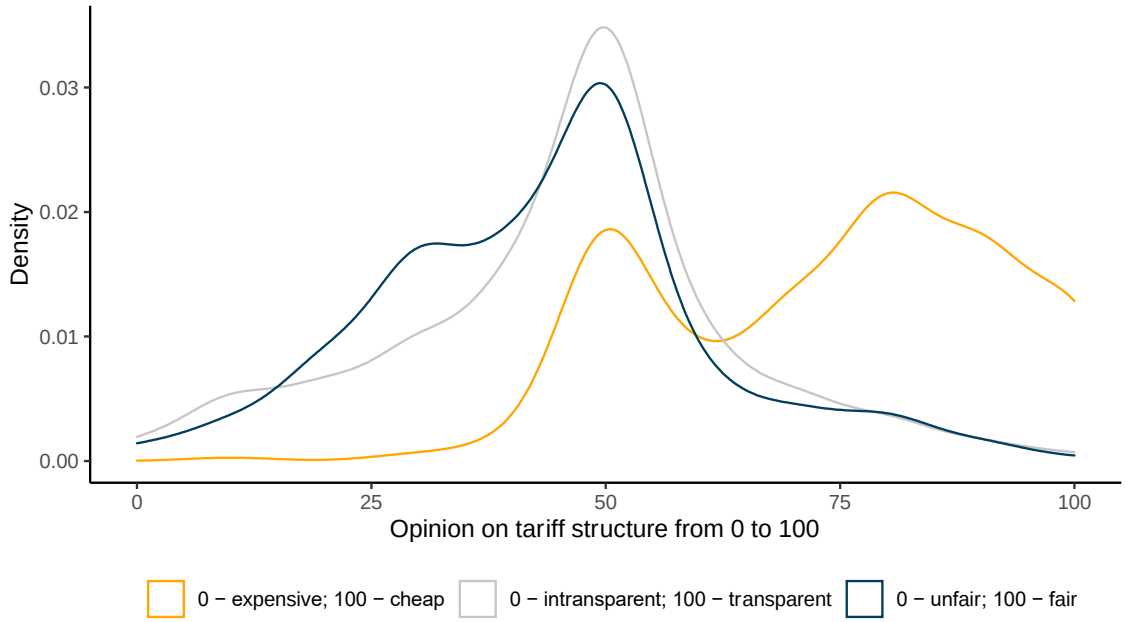

Figure 26: Distribution of attitudes about the split tariff.

Correspondingly, respondents reported a fair amount of peak shaving behaviours (cf. Figure 27). For example, 54% of the sample indicated to nearly always run their laundry machine during the night, another 22% indicated to do so often.[6] Similar magnitudes of peak-shaving behaviour were observed for other actions as well: 62% of the whole sample of respondents indicated to often / nearly always use a timer for their devices to exploit the night tariff, 59% and 55% of the sample indicated to often / nearly always store heat in the water heater and the thermo accumulators respectively. 62% of the sample of respondents indicated to often / nearly always have their dishwasher run during the night. Further, as for the energy saving behaviours, peak shaving behaviours were well aligned across respondents. This allowed us to predict a more reliable summary index of peak shaving behaviours instead of single behaviours.

[6] It should be noted that the shares for every tariff-saving behaviour in Figure 27 are not depicted for the whole sample size of n=300, cf. the real sample size on the right y-axis, due to non-appliance (e.g. if one household doesn't own the respective device). The shares of behaviours in the whole sample, mentioned in the text, may thus not be the shares depicted in the figure itself since the reference size is not the same one.

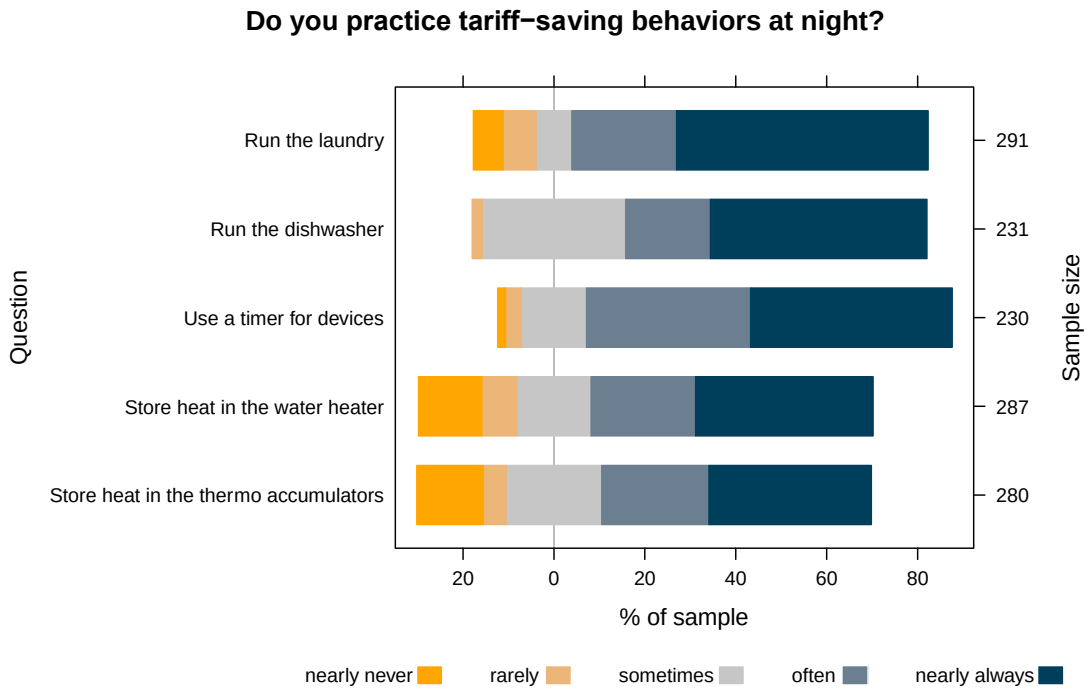

Figure 27: Implementation of peak shaving behaviour.

At the same time, awareness of the low tariff hours was limited in the sample (cf. Figure 28). Only 54% and 45% are aware of the beginning and the end of the low tariff times respectively.

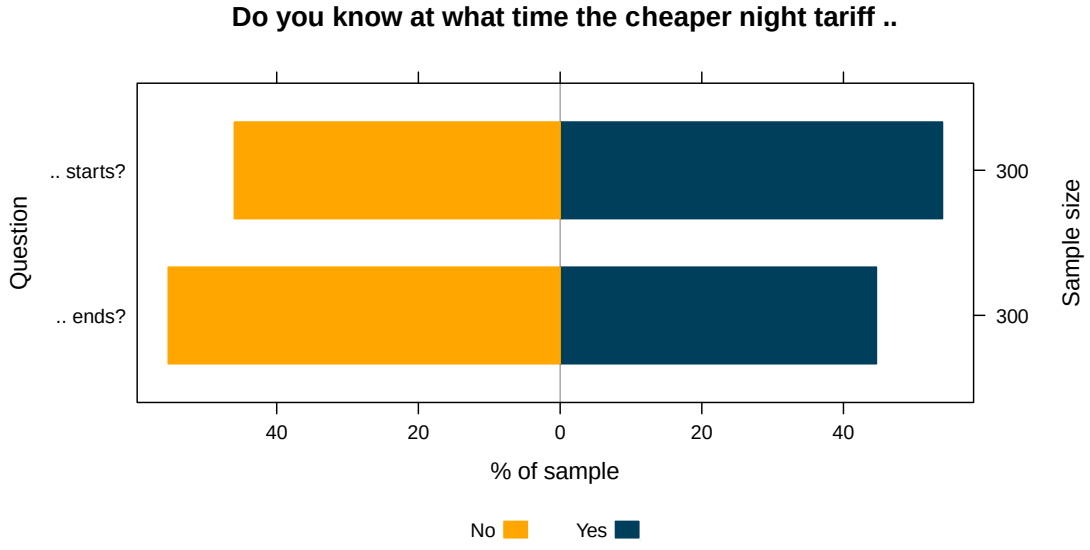

Figure 28: Knowledge of tariff timing.

Further, among those who indicated that they do know (*N*=144), only few are able to indicate the correct end and start time of the night tariff (cf. Figure 29).

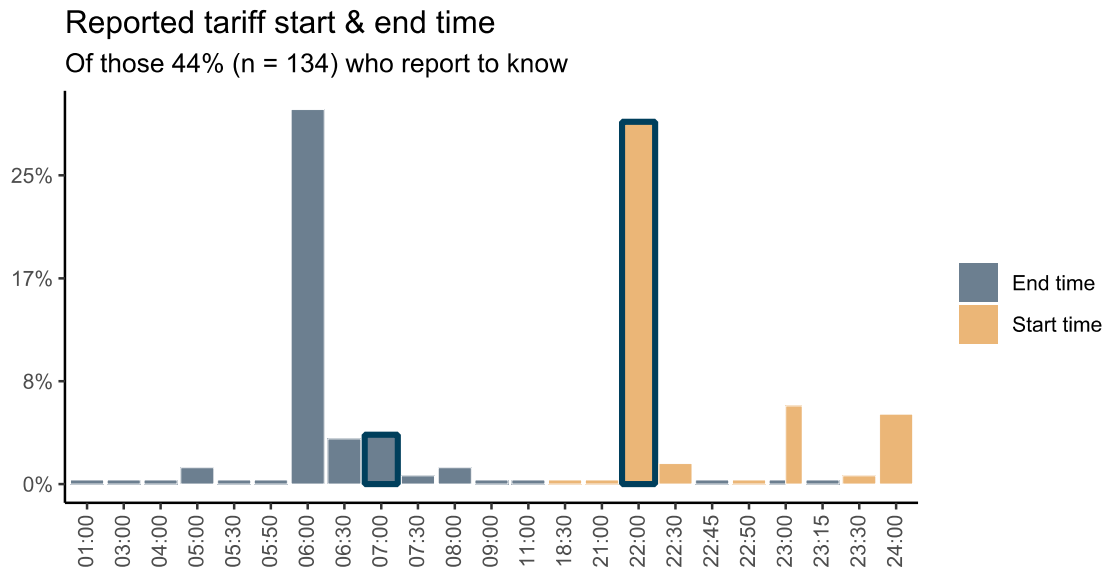

Figure 29: Indicated hours of the day where the night tariff is supposed to end and start.

With the intention to predict peak-shaving behaviours, we further assessed the importance of possible reasons that might promote or prevent one of the identified target behaviours, using the night tariff. Since we were interested in singling out potential entry points for an intervention, reasons were not specified as to whether they were promotive or preventive. For example, if the importance of other household members' preferences relates to saving behaviours, interventions targeting social norms would suggest itself. On average, we found again that the highest importance ratings for using the night tariff were the preferences of other household members (cf. Figure 30).

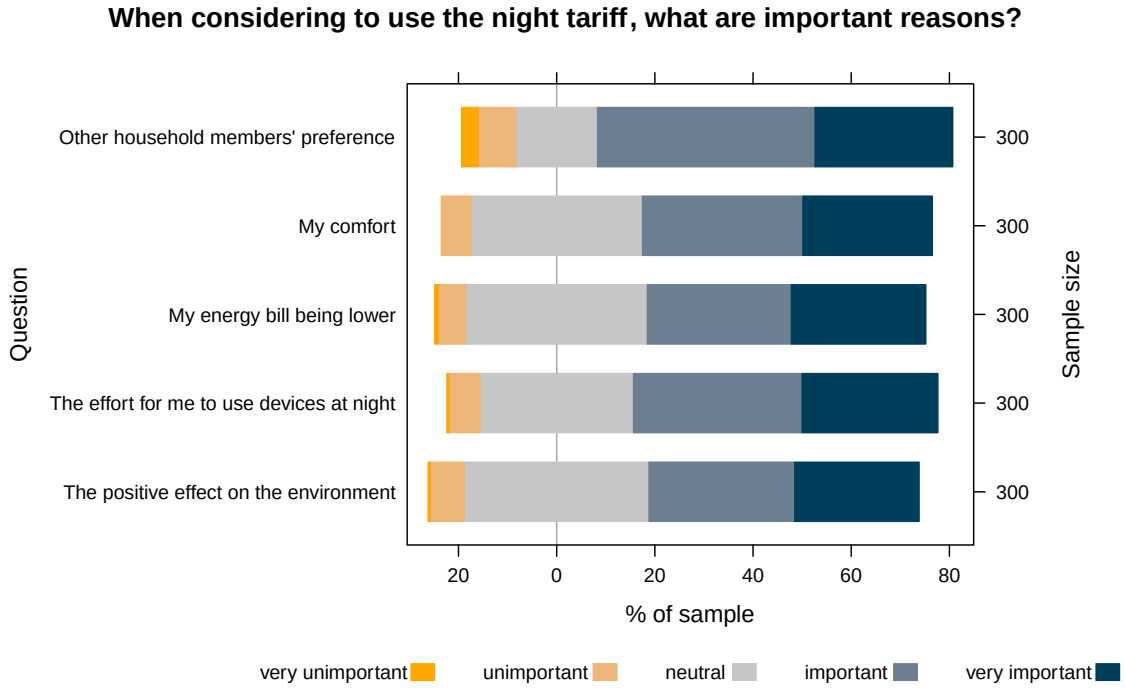

Figure 30: Importance of potential reasons for using the night tariff.

Based on several regression analyses using least squares modelling, we ended up predicting the summary index of peak shaving behaviours from three types of efficacy beliefs and importance of specific reasons to using the night tariff (cf. Figure 30). We used the same efficacy as for predicting energy saving behaviours (see above). To be able to generalize better beyond specific household situations, we statistically controlled for the household size, the family size, and the financial situation.

Five aspects proved reliable in predicting peak shaving behaviours (cf. Figure 31). Respondents who were more convinced that peak shaving behaviours contributes positively to environmental protection and reducing costs were more likely to engage in them. Further, those who rated the importance for lowering the room temperature of family members and comfort were more likely to engage in energy saving behaviours. Those with high importance ratings for effort had a lower propensity for peak shaving behaviours. Overall, the model explained a fair amount of the variability of energy saving behaviours (R^2 = .60).

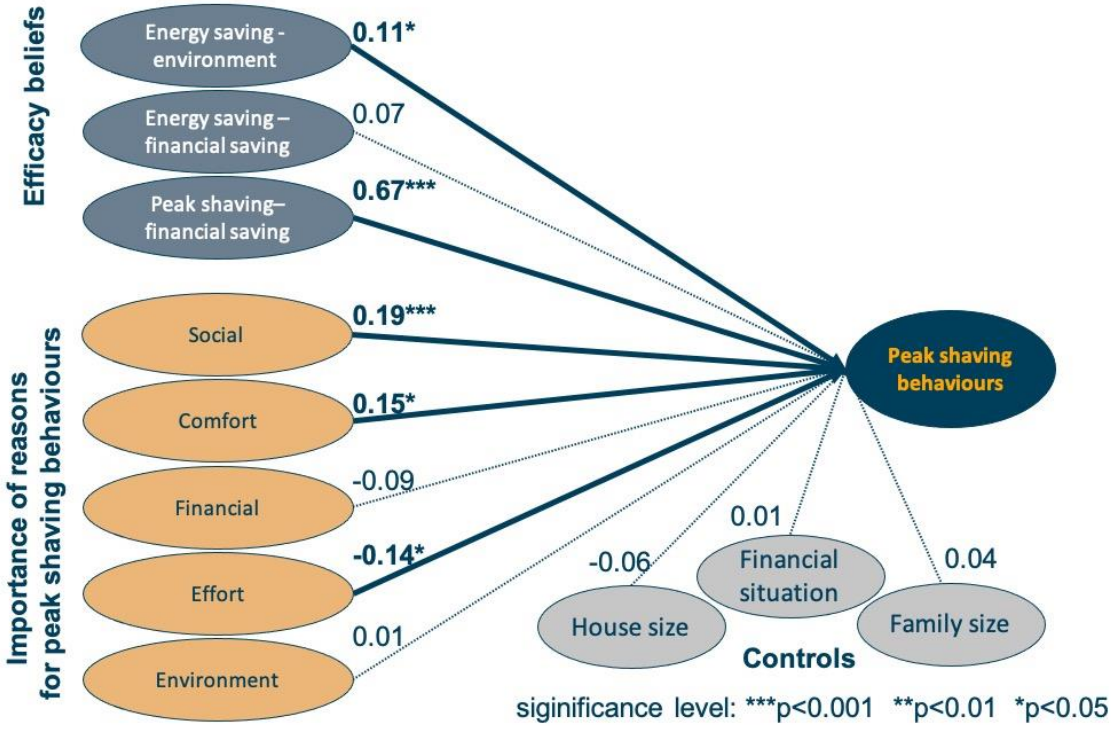

Figure 31: Illustration of the regression model predicting peak shaving behaviours. Numbers represent standardized regression coefficients. Reliable predictors are represented by solid lines.

In sum, peak shaving behaviours also seem widely represented in the sample, as are financial and environmental reasons for performing them. Further, the regression analysis suggested that efficacy beliefs and social aspects might be targeted by interventions. Effort in contrast, seems not as strong of an issue. Those engaging in peak shaving behaviours were less likely to rank effort as an important reason. Additionally, knowledge about the correct hours for the night tariff seemed an issue. Thus, even if inclined to use the night tariff, low subjective knowledge might be a barrier and low objective knowledge might reduce the cost savings obtained. Interventions could thus involve information about the correct hours, about the effect of peak shaving in terms of environmental protection and cost savings and might target inner-household exchanges how to use the night tariff.

4.1.4. Predicting timely electricity bill payment

Finally, some initial insights can be extracted from the survey regarding the third target behaviour, timely payment of the electricity bill. This behaviour is critical for non-payment, and the corresponding cut of the electricity connection, incurs heavy costs for the provider and ultimately for the citizens themselves. To possibly reduce this inefficiency, we tried to understand which the prevalence and reasons for delayed payment. These might relate to the feeling of non-payment being justifiable, to the overall opinions about KEDS/KESCO or to beliefs about the chance of enforcement.

We first validated that our sample comprised respondents that were in the position to pay for electricity (cf. Figure 32). Most respondents, 92%, indicated they had payed for water and electricity services in the month prior to the survey. Somewhat fewer hat payed for internet, mobile phones or media subscriptions and very had payed rent, pointing to the fact that respondents in our survey usually lived in owned property. This mirrors that most people in Kosovo own their homes and therefore are not renting. These values, however, do not indicate whether the payments made for water and electricity had been timely or delayed.

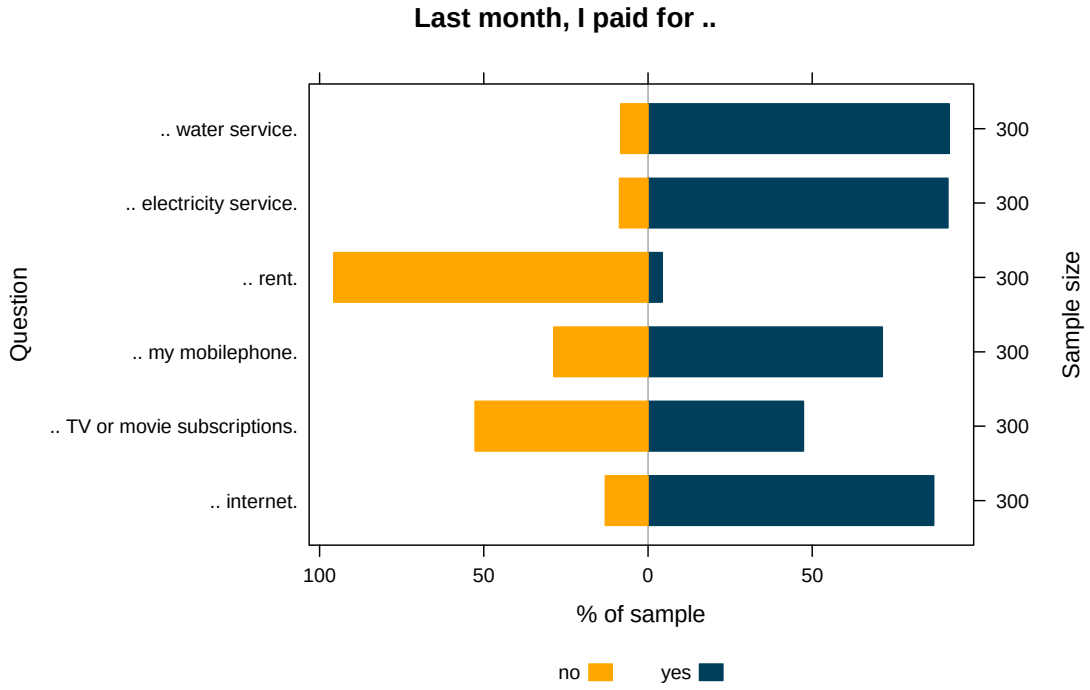

Figure 32: Sample characteristics in terms of regular payments.

When asked directly, about whether they had missed out on a payment in the past, a large share of respondents had at least once neglected payment, namely 58% and 68% respectively. Furthermore, virtually no one seemed to engage in behaviour that aims at complaining or enforcing own interests when those do not receive enough attention (cf. Figure 33).

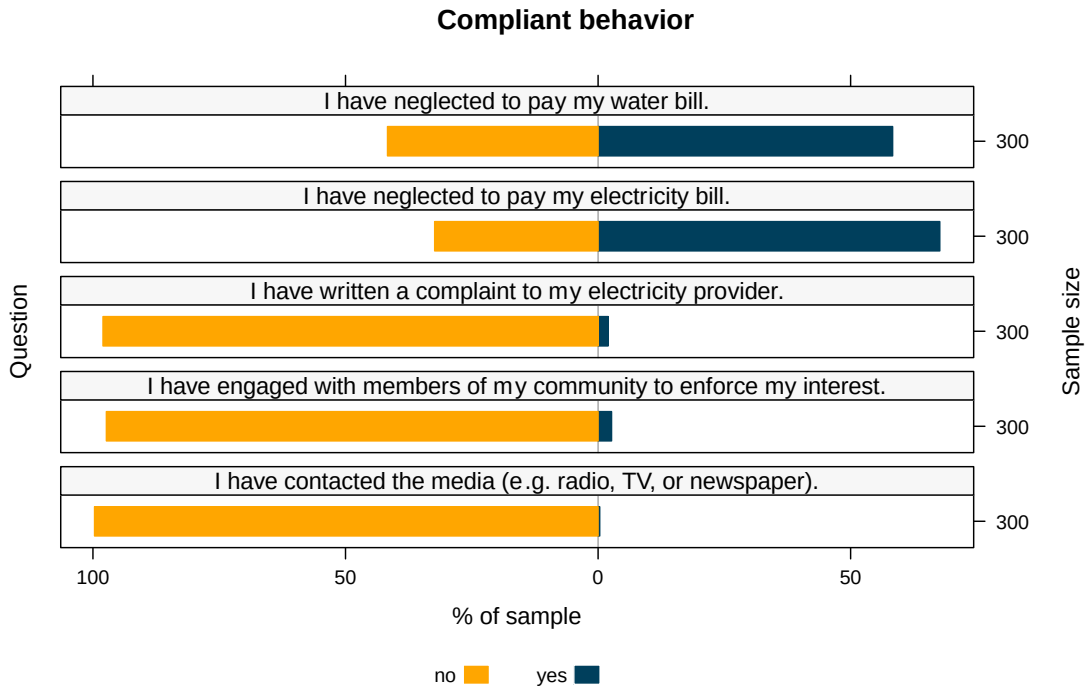

Figure 33: Compliance with timely bill payment and complaining behaviour.

Possible reasons for non-payment of bills are manifold. They range from difficulties with the payment process, to non-reception of the bill to a lack of funds. In this survey we assessed three further reasons that might offer feasible entry points for interventions. We assessed feelings of justifiability of non-payment, beliefs about the likelihood of enforcement of sanctions non-payment and opinions about KEDS/KESCO. Because questions about non-payment might be particularly sensitive to a social desirability biases, we included other questions about non-payment and sanctions for a relative evaluation.

To do so we used a list experiment, which is a questionnaire design technique used to mitigate respondent social desirability bias when eliciting information about sensitive topics, such as compliance to pay a bill. List experiments can be used to estimate the proportion of people for whom a sensitive behaviour is true. The sample was split into two groups and each received a list with sensitive activities. The experimental group was asked how many of 5 sensitive activities; “Using the bus without a ticket”, “Buying or selling things without an invoice.”, “Broke a traffic regulation [e.g. speeding, run a red light].”, “Lied to someone.”, “Complained about a political issue.” plus the target behaviour; “Not payed my electricity bill.” they have conducted. The control group only received a list with the 5 sensitive activities without the target behaviour. If the target behaviour is common, the average number of activities should be higher in the experimental group. We do however find no difference between the two groups, giving no evidence for non-compliant behaviour in our sample. On average the experimental group who received the list with the target behaviour did not conduct more activities than the group that received the list without the target behaviour. The list experiment did not show that there is a tendency for people to neglect paying their bills.

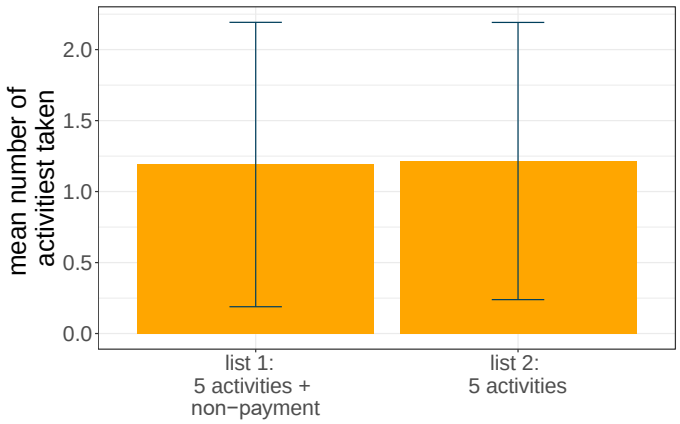

Figure 34: Difference between conditions.

As expected, non-payment was generally indicated to be unjustifiable across several obligations (cf. Figure 35). Not paying property taxes was seen most unjustifiable and not paying for mobile phone services lest unjustifiable. Interestingly, electricity services ranged in the middle with a fair share of 33% of respondents indicating that non-payment is at least acceptable.

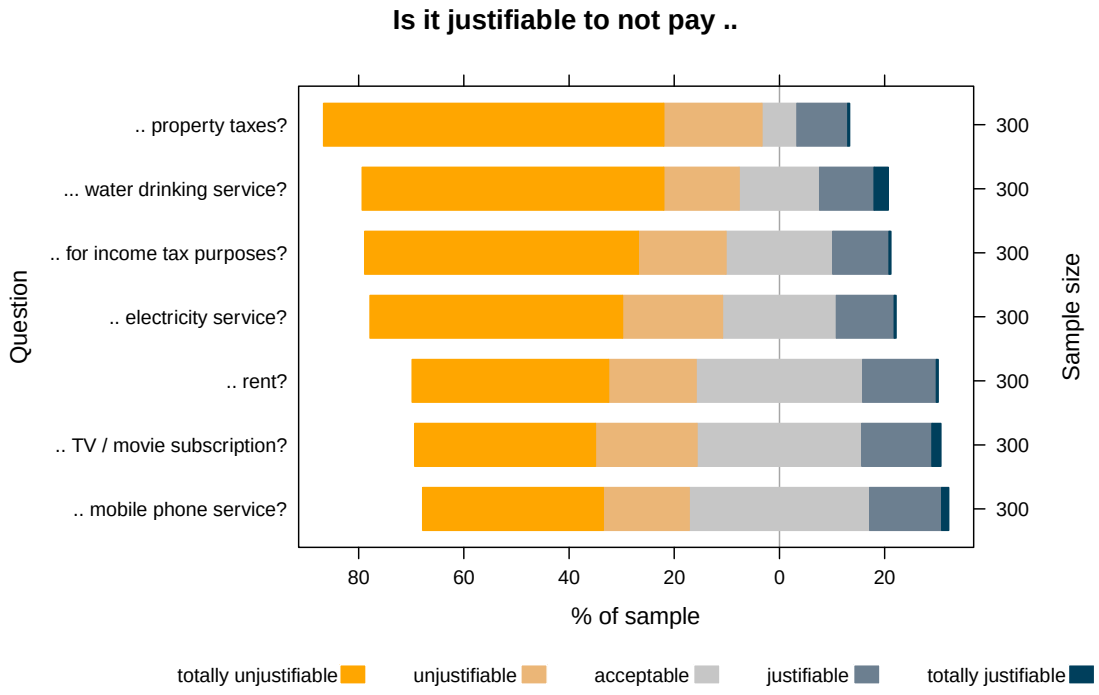

Figure 35: Justifiability of non-payment for services.

For the perceptions of sanctions being implemented, a mixed picture emerged (cf. Figure 36) A large share of respondents was unsure as to whether sanctions would occur following several transgressions. For example, 45% respondents were neutral that one's electricity line would be cut due to non-payment. Only for officials being accepting bribes, respondents seemed more certain, either thinking sanctions in terms of removal from office was either likely or unlikely.

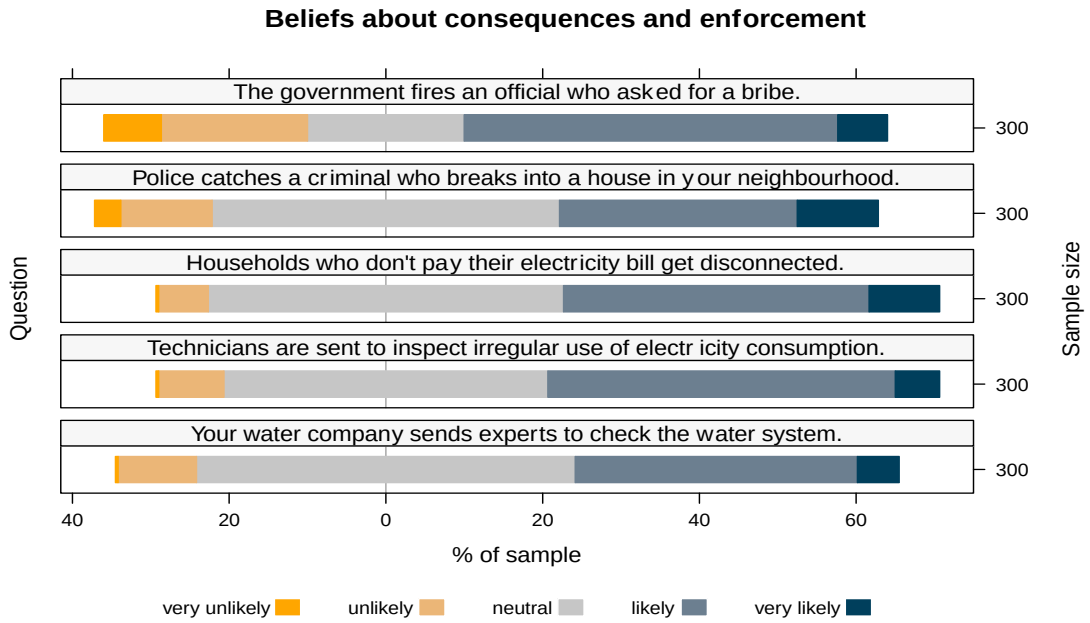

Figure 36: Perceptions about the likelihood of sanctions following several transgressions.

When asked whether respondents think it is possible to get away with not paying for electricity, 46% of the surveyed persons agree (cf. Figure 37).

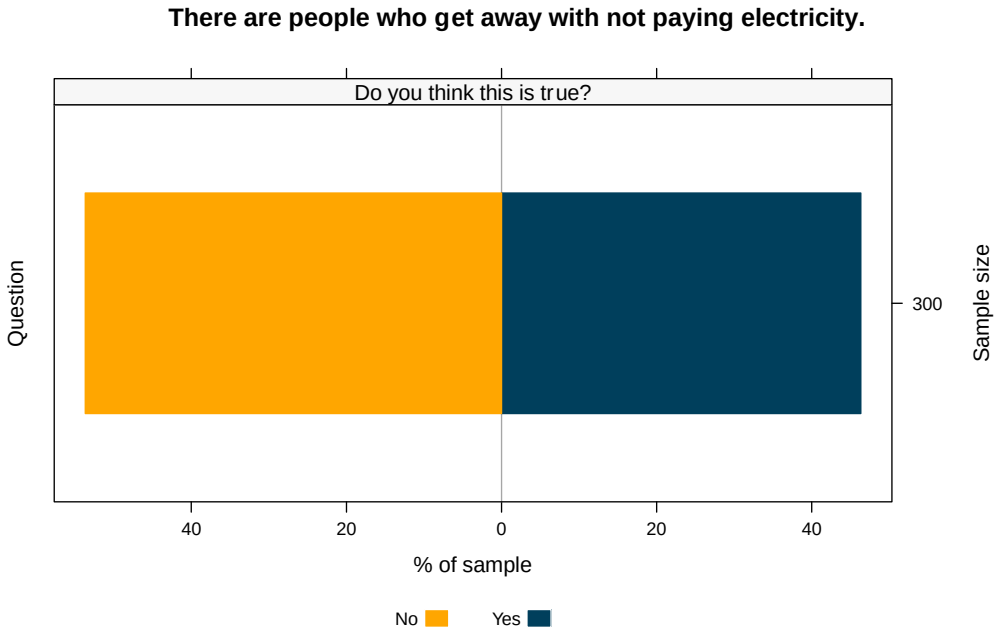

Figure 37: Beliefs about non-compliance.

4.1.5. Opinion about KEDS/KESCO

The opinions about KEDS/KESCO also offer a mixed picture. Because the survey did not include any standards comparisons, the prevalence measures must be taken with care. It is noteworthy though, that opinions see KEDS/KESCO as a profit-oriented company that is less interested in common goods such as environmental protection.

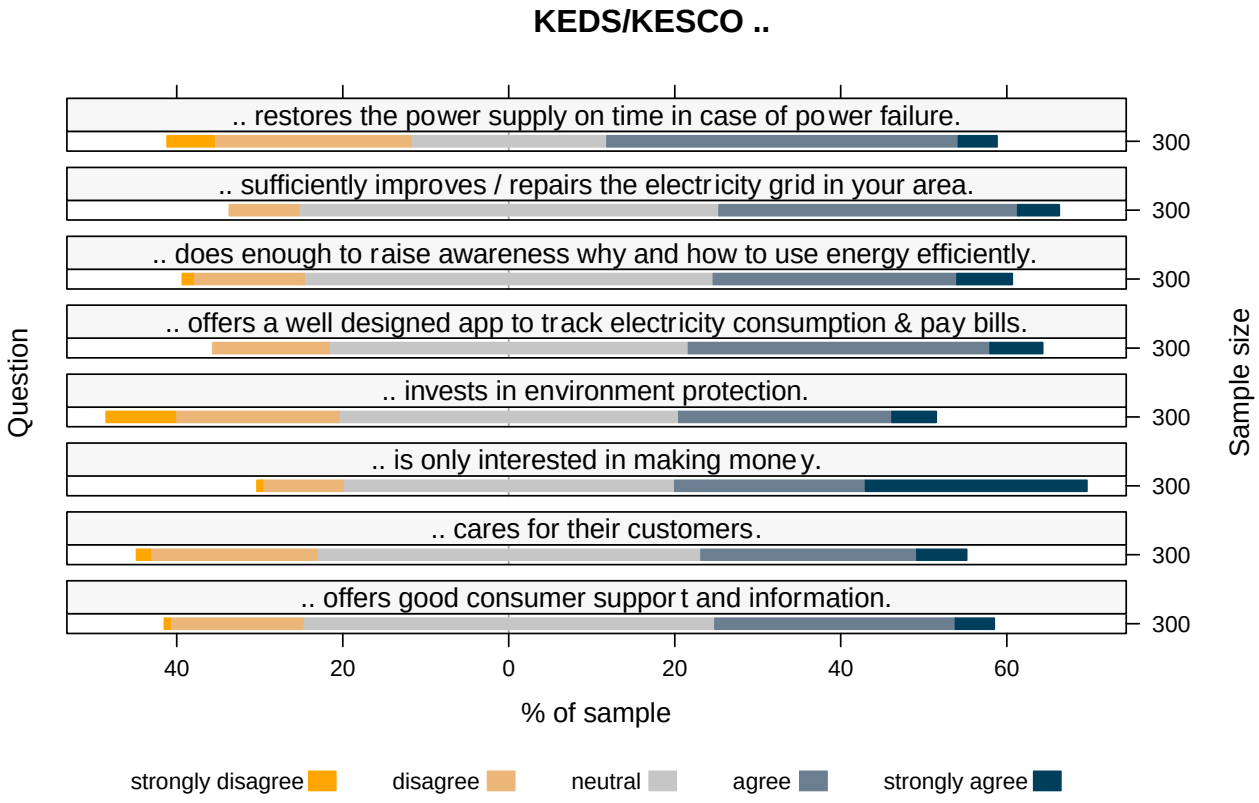

Figure 38: Opinions about KEDS/KESCO.

When asked, what KEDS/KESCO could improve, 54% of respondents wish for lower electricity prices. Other recommendations that were made towards KEDS/KESCO was to improve the supply, customer service and transparency. A suggestion that was made was for KEDS/KESCP to provide a more flexible deadline to pay for energy bills. It is important to mention that 21 % said nothing had to be changed or did not have any suggestions (“don’t know” + “nothing”).

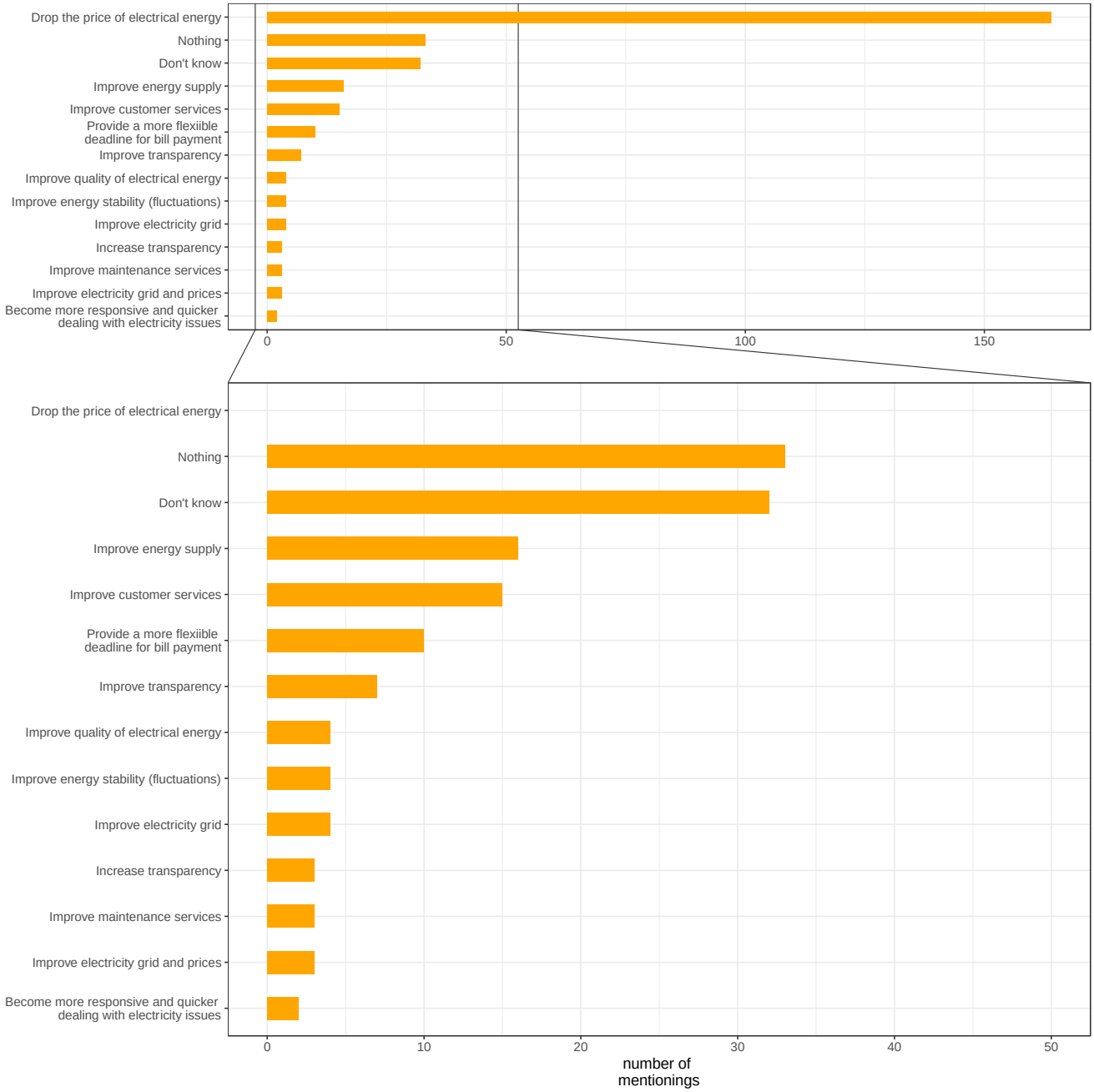

Figure 39: Opinions on KEDS improvements.

5. Behavioural Field Experiment

The project set out to use behaviour insights to change behaviour patterns relating to electricity consumption. Resulting from stakeholder dialogues, including the Kosovo Energy Project and KEDS/KESCO as the electricity utility, we focus on three sets of behaviours: Energy saving behaviours, peak shaving behaviours and the timely payment of electricity bills.

We decided to implement an experiment on peak shaving. The focus on peak shaving behaviours was chosen because our survey results hint at the potential of cost-efficient informative interventions. Specifically, knowledge about the correct hours of the night tariff was low among the respondents. Further, uncertainty remained for the important conviction that peak shaving would be effective for cost saving or environmental protection. An informational campaign targeting these three uncertainties might thus prove effective, albeit constituting a low threshold intervention.

5.1. Experimental Design and Procedure

To test these predictions about different aspects of the informational content, we designed a randomized controlled trial (RCT) with five experimental conditions (cf. Figure 41). The allocation of the participating households to their respective experimental condition was carried out in a randomized manner for both the control and the treatment groups. The control group of households was billed as usual; no additional information was provided with their electricity bills. The four treatment groups received flyers in addition to their monthly bill with graphically simplified information about the correct hours of the night tariff and concrete advice on how to implement peak shaving (cf. Figure 42). Amongst those households receiving information, four different forms of informational content were distinguished among the treatment groups: It was manipulated whether information about cost or environmental impact was appealed to on the flyers. The treatment groups (2 & 4) that contained a financial appeal, included information about the tariff price. The treatment groups (2 & 3) that contained an environmental appeal, included a visualisation of a burning planet at high peak hours (at 8:00 – 10:00 and 19:00 – 21:00).

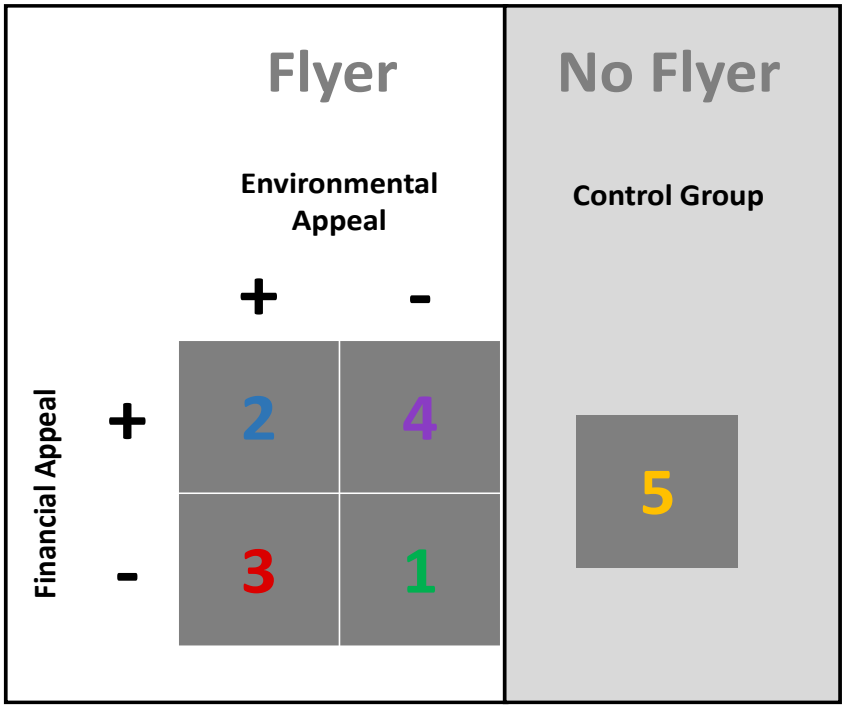

Figure 41: Schematic illustration of the experimental design of the RCT. For comprehensible representation, the grouping colours are consistent throughout the following graphs.

Furthermore, to keep the flyers interesting, maintaining the attention paid by households, and to maximise the information provided, a varying advice about an exemplary energy saving behaviour was printed on the flyer every month (cf. Figure 43). This advice varied over the months of the intervention period, yet, was equivalent throughout all treatment arms. Moreover, the change in tariff hours from summer to winter was highlighted on the flyers.

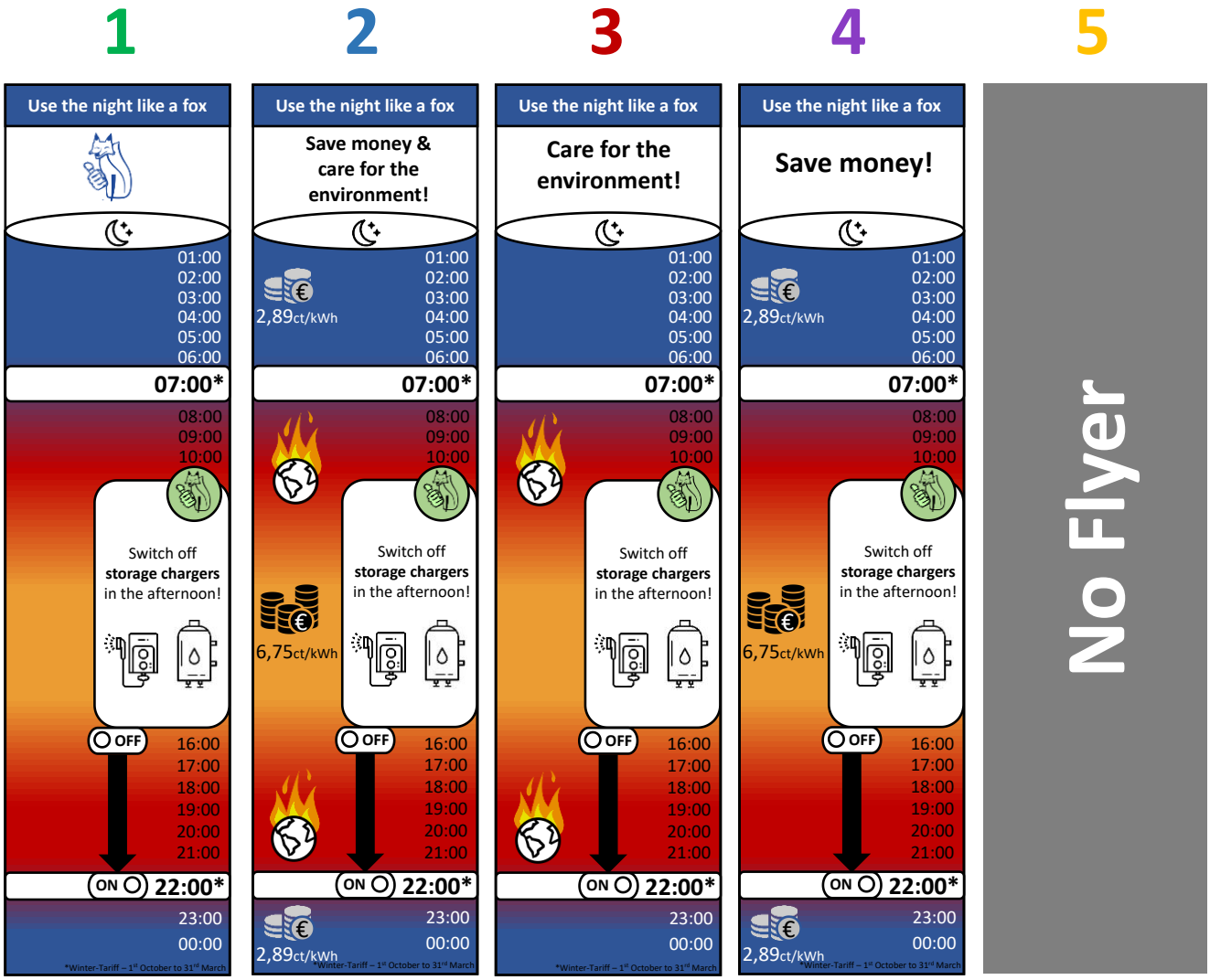

Figure 42: English versions of the flyers corresponding to the experimental conditions.

Flyers were distributed monthly over the course of six months by KESCO enumerators from November 2020 to May 2021. Sampling was based on the data provided by KEDS/KESCO. Overall, data of 3,138 households was obtained. The intervention region matched the survey region. Cluster randomization of experimental conditions was carried at enumerator level. This way, each enumerator only provided one type of flyer, equivalent to one experimental condition. This was done to drastically simplify the distribution process of flyers for enumerators and reduce error-proneness (e.g. enumerators having to keep track and change flyers). There were 95 enumerators in total.

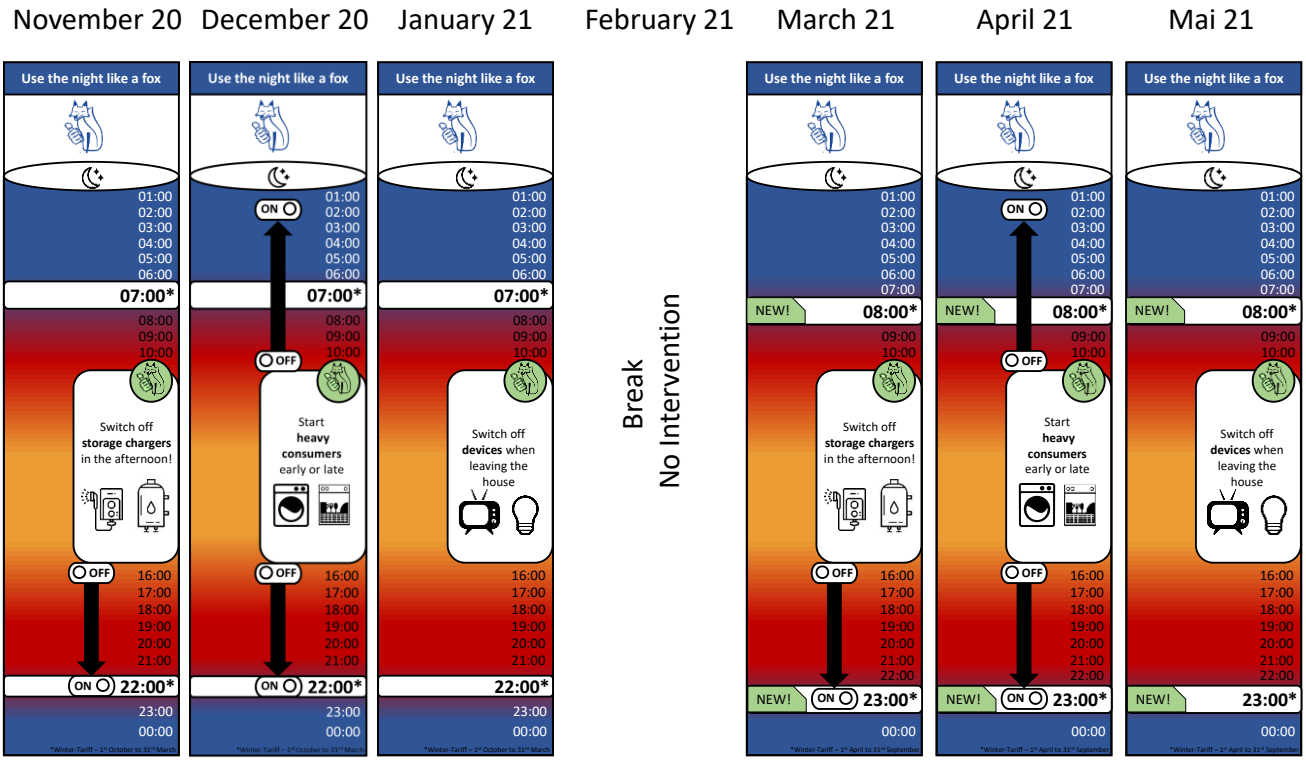

Figure 43: English versions of the flyers illustrating the different energy saving tips for condition 1.

Flyers were distributed together with energy bills and were either directly handed to a household member, stuck into the door frame / mailbox or placed on the doorstep (cf. Figure 44).

Figure 43: Illustration of different flyer delivery methods.

5.2. Results

We tested whether distributing information via flyers and, additionally, whether using different efficacy appeals influenced energy consumption patterns. The data was analysed using statistical analysis such as multilevel modelling (cf. Appendix for the detailed results). As expected, a pronounced seasonal variation can be observed (cf. Figure 44). Therefore, all analyses control for the monthly consumption of the previous year. In addition, analyses control for the average absolute and low tariff household consumptions.

For the central effect of different interventions, the analyses revealed no statistically reliable effect on electricity use as compared to the no-flyer control group. On average, households who received one of the intervention flyers did neither consume less electricity in total (cf. Figure 44) nor did they use electricity at a higher ratio during the low tariff (cf. Figure 45).

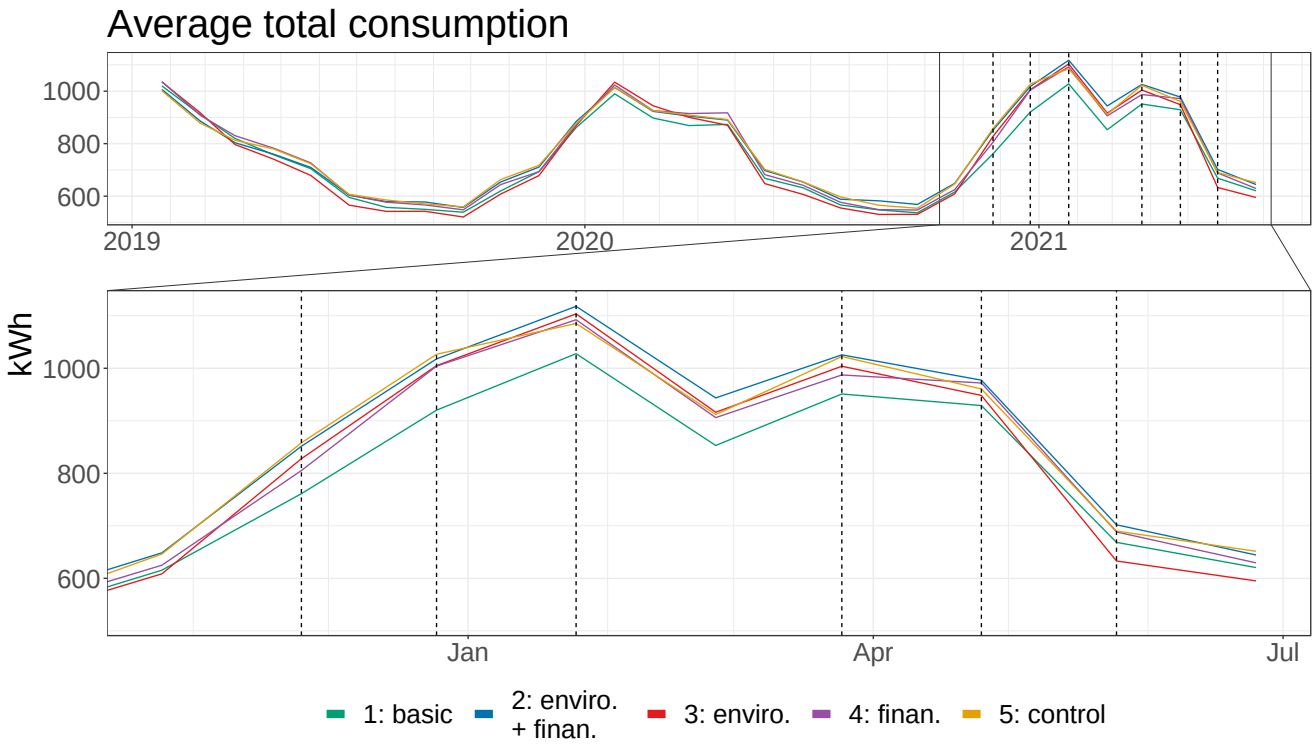

Figure 44: Total household energy consumption across time and by different experimental conditions. Dotted lines represent the point in time when flyers were distributed. If an effect would exist, averages between intervention groups compared to control and the basic information flyer would be larger.

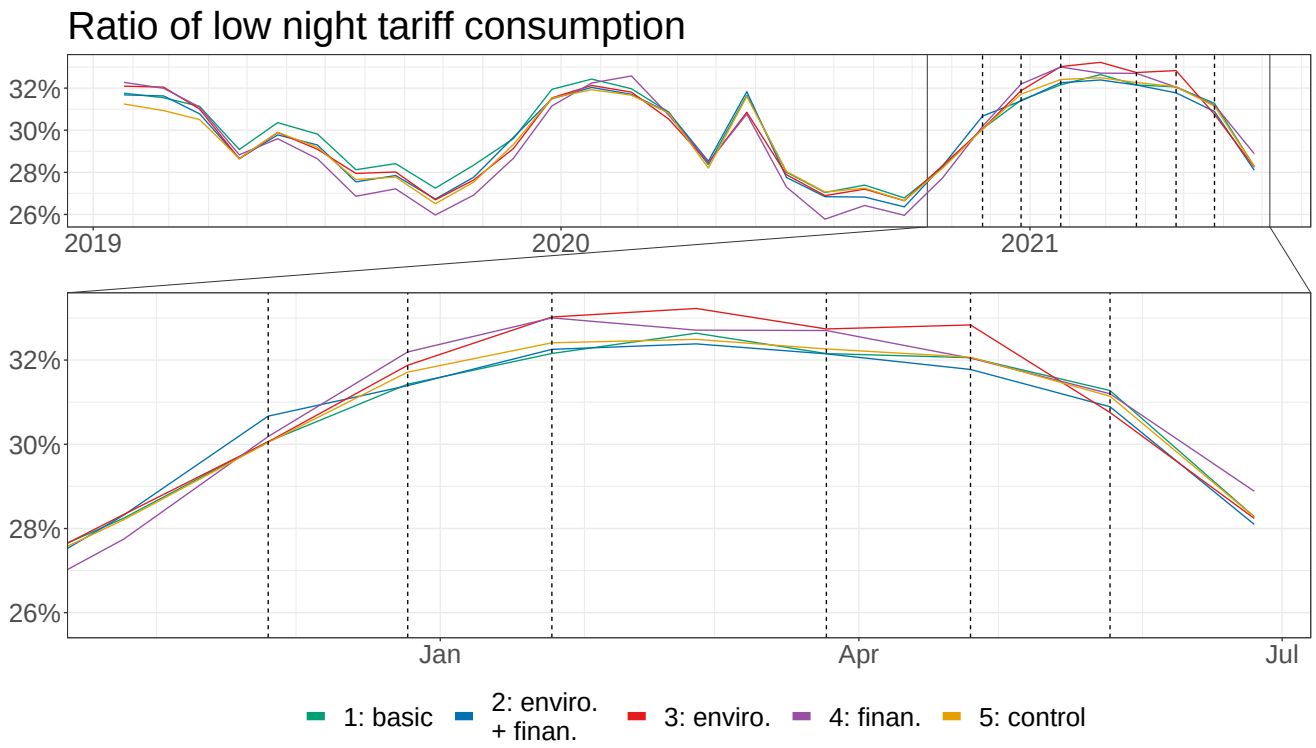

Figure 45: Percentage of low tariff consumption across time and by different experimental conditions. Dotted lines represent the point in time when flyers were distributed. If an effect existed, averages between intervention groups compared to control and the basic information flyer would be larger.

Segmenting households by consumption characteristics, the analysis revealed differential effects depending on the previous total and low-tariff consumption patterns. The models indicate that the intervention had a behavioural effect on households with relatively high total electricity consumption levels in the previous year. For these consumers, a rebound effect emerged. Households with high historical electricity consumption levels who did receive a flyer were more likely to increase their electricity consumption than households in the control group who did not receive a flyer (cf. Figure 46).

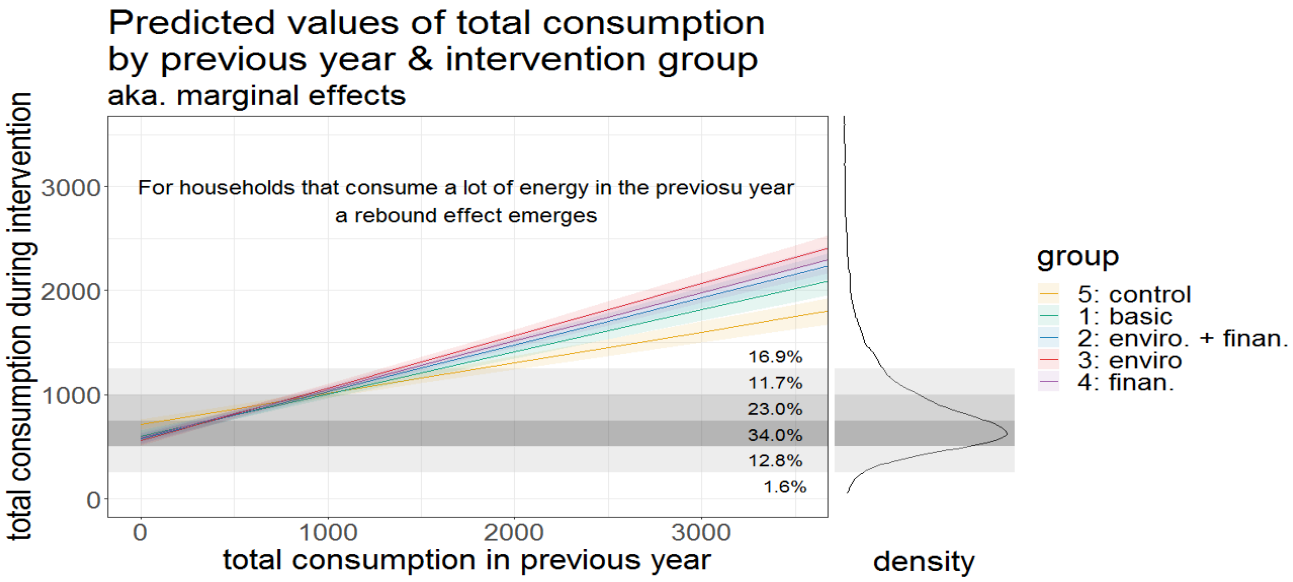

Figure 46: Predicted values of total consumption by previous year & intervention group. Differences between the lines are significant at p<0.05. Density distributions are shown at the side of the plot. Shaded areas indicate percentages in the equivalent bracket

The models further indicate that households who were already using the low tariff to a larger extent in the previous year reacted differently than those who did not. For those households, receiving an environmental (group 3: red line) or financial (group 4: purple line) flyer increased the ratio of low tariff consumption. Surprisingly the environmental + financial (group 2: blue line) flyer did decrease the ratio of low tariff consumption slightly (cf. Figure 47).

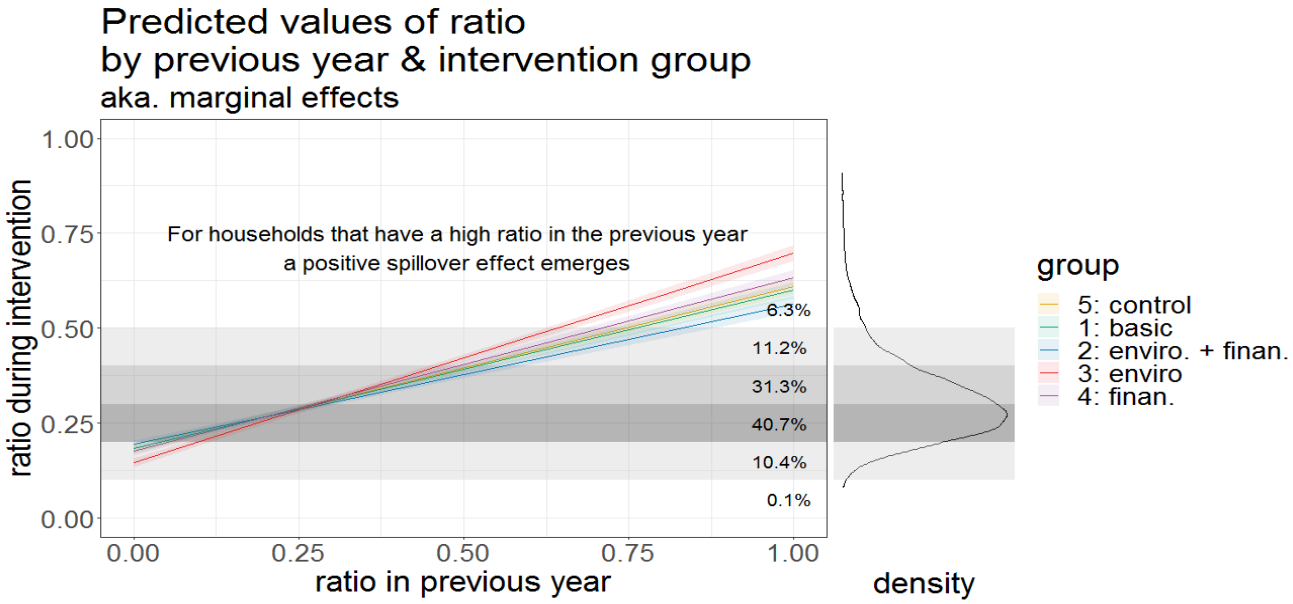

Figure 47: Predicted values of ratio by previous year & intervention group. Differences between the lines are significant at p<0.05. Density distributions are shown at the side of the plot. Shaded areas indicate percentages in the equivalent bracket

5.3. Discussion of RCT results

The results of the field experiment allow to conclude that, overall, the distribution of simplified and informative flyers did not change energy consumption patterns for most households, neither in absolute terms nor with regard to the relative usage of the low tariff. Thus, even though knowledge about the low-tariff hours is a very likely bottleneck, removing knowledge deficits with information was, in line with previous findings, not sufficient to change behaviour.

Further, the intervention did have effects depending on household characteristics. For absolute electricity consumption, it was observed that flyers further increased, rather than decreased, total electricity consumption the more households had consumed before the intervention. We can only speculate about the reasons for the adverse effect. One possible explanation is resistance to the influence attempt. This is substantiated by a reanalysis of the survey data, showing that households with high total consumption are those trusting less in the electricity provider.

Regarding peak shaving, the intervention had some conditional positive effects. For households characterized by high pre-intervention shares of low-tariff consumption, the environmental appeal strengthened this pattern. This can be seen as an instance of positive spill over of pro-environmental behaviour, where previous behaviours can be built upon further promote other similar behaviours. Most likely, this further increase was caused by strengthening people's efficacy beliefs regarding their impact on the environment.

These conclusions can be drawn with some certainty for three reasons. First, households were randomly assigned to the different treatment and control conditions and there were no significant a priori differences between the experimental conditions in the consumption data. Further, the number of households treated and repeatedly measured was large enough to detect even small systematic changes in the consumption patterns. Finally, the measurement itself was based on the actual consumption as compared to more noisy self-report or self-assessment measures. As such, we are looking at a high-quality RCT that was made possible by the cooperation between all involved stakeholders.

Inferences as to why the interventions did not have a larger effect on energy consumption patterns are difficult. One plausible reason reducing the intervention's effectiveness might have been the delivery via flyers. One factor that affected the decision to use flyers was the current COVID situation which made a direct interaction with households infeasible. Another reason were financial limitations that restricted the use of other more resource intensive communication channels to reach households.

Yet, behavioural barriers arise with the use of flyers or other mailings. It is uncertain how thoroughly flyers were read by household members. Often, they are seen as annoyance and quickly discarded. Since they are received at the door, trash bins tend to be close by which makes it easy to quickly discard them, making it less likely for them to reach much attention and less likely to be take in into the house where they could be viewed and discussed by other household members. Furthermore, timing matters. Research has shown that regular reminders near the time of the desired action lead to stronger effects. Yet, the flyers were usually retrieved once a household member left or entered the household or early in the morning. In most cases this will have been hours before desired peak shaving options.

Another plausible reason is motivation. Assuming that knowledge barriers and efficacy beliefs were successfully addressed by the intervention, motivation to act for climate change or possible financial savings might not have been enough. Social motivators were, for example, absent in the intervention. Successful social motivators to encourage pro-environmental energy behaviour are for example the use of gamified feedback or feedback on the joint progress of a household or neighbourhood made towards an environmental or financial goal.

In general, a trend of increasing electricity consumption is observable over the last two years. Possible explanations for this trend can only be assumed: Increasing weather extremes and a shift from coal, pallet and oil towards electricity heating systems. Due to its continental geographically Kosovo experiences large annual temperature changes. Temperature extremes have become more likely in continental regions due to climate change. With the introduction of a new electricity price scheme in 2017 block tariffs (increasing electricity prices at certain consumption levels) were replaced with the night and day tariff. Where it was uneconomically before 2017, it has now become a lot more lucrative for households to heat with electricity. In line with this explanation for the increase in electricity consumption, it has been reported that sales of electricity heating systems are steadily growing. It can be expected that this trajectory will continue for the upcoming years, making initiatives for energy efficiency to counter increasing consumption trends and to promote peak shaving even more pivotal for a sustainable future.

In sum, we would however not recommend upscaling this particular intervention. Rather suggest focussing on interventions using different channels and motivators. As our intervention shows, heavy consumers differ from average and low consumers, therefore an intervention taking different consumer groups into account is recommendable. An intervention seems advisable that addresses uptake and timing issues and makes use of additional more social motivators. Making use of the eKESCO App, that allows customers to monitor their consumption, seems a promising candidate for an intervention to deliver timely, targeted and social incentives.

6. Conclusion

In this project, behavioural insights were applied to change energy consumption patterns of urban households in and around Pristina, Kosovo. In a first phase, a behavioural context analysis was performed. It consisted of stakeholder interviews and a household survey. They were conducted to investigate consumers' motivations and barriers to specific energy efficiency behaviours. The survey revealed that participants lacked knowledge about the energy tariff structure. Efficacy beliefs, the conviction that one's actions have a positive effect on the environment and the energy expenditures did have the largest influence on whether participants were willing to engage in saving and peak shaving behaviours.

The insights from the behaviour analysis were used to design an intervention in which the knowledge and efficacy beliefs were strengthened. The intervention was delivered monthly using flyers. The flyers contained information about the starting and end time of the lower night tariff as well as contained narratives that were meant to fortify efficacy beliefs. Analysis of the energy consumption data of over 3,000 households suggest that the intervention was ineffective overall. The distribution mode, flyers, or lack of social motivators might account for the lack of an effect. More dynamic delivery methods, such as an App, and social motivators are necessary.

On a project level, we conclude that a large share of time and resources went into building trust, commitment and ensuring communication between all stakeholders. From our point of view, the behavioural analysis facilitated this process. At the same time the COVID situation delayed the process, for example by preventing in-person meetings. By involving the consulting behavioural scientists in these steps, the resources necessary to deliver the behavioural science input largely exceeded that contractually provided.

7. Appendix

Table 1:

multilevel models for Log ratio of low to high tariff consumption

	log ratio per month			
	(0)	(1)	(2)	(3)
group 1: basic		-0.0003	-0.001	-0.002
		(0.008)	(0.005)	(0.005)
group 2: enviro + finan.		-0.007	-0.007	-0.006
		(0.008)	(0.005)	(0.005)
group 3: enviro.		-0.001	0.001	0.001
		(0.008)	(0.005)	(0.005)
group 4: finan.		-0.0001	0.002	0.003
		(0.008)	(0.005)	(0.005)
log of ratio in previous year (log ratio pre)			0.133***	0.125***
			(0.002)	(0.005)
log of total consumption before intervention (log sum total)			0.030***	0.029***
			(0.004)	(0.009)
period 1: January			0.0058***	0.005***
			(0.001)	(0.001)
period 2: February			0.008***	0.007***
			(0.001)	(0.001)
period 3: March			0.010***	0.009***
			(0.001)	(0.001)
period 4: April			0.019**	0.019***
			(0.001)	(0.001)
period 5: May			-0.008***	-0.007***
			(0.001)	(0.001)
period 6: June			-0.019***	-0.018***
			(0.001)	(0.001)
group 1 x log ratio pre.				0.003
				(0.007)
group 2 x log ratio pre.				-0.016**
				(0.006)
group 3 x log ratio pre.				0.037***
				(0.006)
group 4 x log ratio pre.				0.014**
				(0.006)
group 1 x log sum total				0.005
				(0.013)
group 2 x log sum total				-0.004
				(0.014)
group 3 x log sum total				-0.004
				(0.013)
group 4 x log sum total				-0.006
				(0.013)
log ratio pre. x log sum total				0.088***
				(0.006)
Constant	0.315***	0.317***	0.314***	0.312***
	(0.003)	(0.006)	(0.004)	(0.004)
Var: employer x household	0.01	0.01	0.01	0.00
Var: employer	0.00	0.00	0.00	0.00
Var: Residuals	0.00	0.00	0.00	0.00
Observations	17591	17591	17591	17591
Log Likelihood	22 216.230	22 200.540	24 498.680	24 595.170
Akaike Inf. Crit.	-44 424.470	-44 385.090	-48 965.360	-49 130.350
Bayesian Inf. Crit.	-44 393.370	-44 322.890	-48 840.960	-48 897.090

Note: significance levels: *p<0.1; **p<0.05; ***p<0.01

Table 2:

multilevel models for total consumption

	log sum per month			
	(0)	(1)	(2)	(3)
group 1: basic		-0.009	-0.0004	-0.003
		(0.043)	(0.020)	(0.020)
group 2: enviro + finan.		0.028	-0.002	0.005
		(0.043)	(0.020)	(0.020)
group 3: enviro.		0.021	0.022	0.023
		(0.043)	(0.020)	(0.020)
group 4: finan.		0.024	0.016	0.017
		(0.043)	(0.020)	(0.020)
log of total consumption in previous year (log sum pre)			0.472***	0.385***
			(0.007)	(0.015)

log of total consumption before intervention (log sum total)			0.526***	0.544***
			(0.019)	(0.041)
period 1: January			0.002	-0.004
			(0.007)	(0.007)
period 2: February			-0.133***	-0.139***
			(0.007)	(0.007)
period 3: March			-0.025***	-0.030***
			(0.007)	(0.007)
period 4: April			-0.035***	-0.040***
			(0.007)	(0.007)
period 5: May			-0.213***	-0.207***
			(0.007)	(0.007)
period 6: June			-0.262***	-0.252***
			(0.007)	(0.007)
group 1 x log sum pre.				0.047**
				(0.020)
group 2 x log sum pre.				0.114***
				(0.020)
group 3 x log sum pre.				0.198***
				(0.019)
group 4 x log sum pre.				0.106***
				(0.020)
group 1 x log sum total				0.024
				(0.058)
group 2 x log sum total				-0.118**
				(0.059)
group 3 x log sum total				-0.107*
				(0.058)
group 4 x log sum total				-0.016
				(0.059)
log sum pre. x log sum total				0.348***
				(0.014)
Constant	6.677***	6.664***	6.763***	6.725***
	(0.013)	(0.030)	(0.015)	(0.015)
Var: employer x household	0.16	0.16	0.07	0.07
Var: employer	0.01	0.01	0.00	0.00
Var: Residuals	0.11	0.11	0.06	0.06
Observations	17,591	17,591	17,591	17,591
Log Likelihood	-8 556.223	-8 565.160	-3 022.233	-2 665.524
Akaike Inf. Crit.	17 120.440	17 146.320	6 076.465	5 381.048
Bayesian Inf. Crit.	17 151.550	17 208.520	6 200.868	5 575.426

Note: significance levels: *p<0.1; **p<0.05; ***p<0.01