

Hrvatska zaklada za znanost  
Fakultet elektrotehnike i računarstva, Zagreb  
Zavod za visoki napon i energetiku

# ANIMATION

## D1.21. Questionnaire on Energy Usage in Households - Report

Vedran Bobanac, PhD  
Assoc. Prof. Hrvoje Pandžić, PhD



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# 1. Introduction

This report presents results of the questionnaire on energy usage in households which has been conducted as a part of the scientific-research project entitled ANIMATION (Active NeIghborhoods energy Markets pArTicipatION). The project is lead by Assoc. Prof. Hrvoje Pandžić at UNIZG-FER.

Demand response (DR) refers to the ability of electrical load to change its consumption pattern in order to provide flexibility to the power system operator, in electricity market or to other power system users. Almost all of the demand response provided today is either industrial or commercial, as residential sector is much more delicate and complex to design due to a huge number of distributed resources as well as impact on people's everyday lives. The ANIMATION project aims at inclusion of households in the DR, which is possible if many housholds participate in energy markets jointly.

The goal of this questionnaire is to provide information about DR and household electricity management to users, and at the same time, get their feedback on this topic. In order to get as many responses as possible, an attempt is made to make the questionnaire both educational and fun. The main goals of the questionnaire are: (i) determining the way people use their household appliances (usage profile) and (ii) assessing their willingness to participate in DR, which may imply change in their habits.

## 2. Discussion of the Results

The results of the questionnaire are presented by the figures in the Appendix, while their discussion is given as follows.

Fig. 1 and 2 display age and sex of the respondents respectively. Fig. 3 is somewhat vague because respondents manually entered their country of residence, which resulted in various entries for the same country. Breaking down Fig. 3 it turns out that vast majority of the respondents come from Croatia (103 or 84%), Bosnia and Herzegovina is on second place with 11 respondents (9%), two respondents are from the USA (1.6%), while only one respondent (0.8%) comes from the following countries: Australia, Austria, Italy and Netherlands. Finally, one respondent did not specify her/his country. The total number of responses is 122.

Fig. 4 shows that majority of respondents own an object in which they live (41.8%), while about 1/3 of the respondents still live with their parents which indicates that they might not be familiar with electricity bills and electrical energy management. Fig. 5 shows that majority of respondents' households consists of four, three or two members, while Fig. 6 displays that almost 3/4 of the respondents live in apartment buildings.

Fig. 7 and 8 show that 60% of the respondents keep track of their electricity bills, while 63% think that electricity bills are not significantly burdening their home budget. From Fig. 9 it can be concluded that significant portion of the respondents (46%) cannot estimate their monthly consumption of electrical energy in kWh.

Fig. 10 displays that majority (64%) of the respondents actively try to reduce their electrical energy consumption most of the time, while another 26% does it sometimes. This indicates potential for inclusion of households in the demand response (DR), since DR implies reduction in electricity bills at the expense of users' habit change. Fig. 11 shows that respondents have various expectations about financial compensation for their participation in DR, however almost half of them (49%) would be satisfied with up to 25% reduction in their electricity bills. Vast majority of the respondents (81%) would include their refrigerator/freezer in the automatic DR program, provided that does not change the way they use their appliance(s). However, only 16% of the respondents would be willing to postpone opening their refrigerator/freezer (for a fee), without considering it a hassle, as indicated by Fig. 13.

As seen from Fig. 14 and 15 roughly 27% of the respondents would unconditionally be willing to change the temperature in their home at the request from their supplier/aggregator (comfort reduced in return for a fee).

Fig. 16 shows that 56% of the respondents would always be willing to postpone usage of their washing machine (and/or tumble dryer and/or dishwasher), while another 34% would generally be willing to do so (but not always). According to Fig. 17, even larger percentage (93% of the respondents) would be willing to set a time frame for running their washing appliance (and/or dryer) and then let a smart algorithm do the rest.

From Fig. 18 it can be concluded that respondents are generally not likely to postpone usage of their cooking appliances in return for a fee. Likewise, only 17% of the respondents would unconditionally be willing to postpone usage of their electrical water heater (showering, washing dishes), as seen in Fig. 19.

### 3. Conclusion

From the results of this questionnaire it can be concluded that people are generally open to the idea of including their household in the some kind of demand response (DR) program. A very small percentage of respondents is not open to new technologies and new energy management paradigm.

Somewhat expectedly, results show that household appliances that show the greatest potential for inclusion in the DR are those which can be included automatically, meaning the users' comfort is not disturbed and they do not have to make any decisions. Such appliances are refrigerators, freezers, washing machines, dishwashers and tumble dryers.

Next, appliances that show a little less potential for inclusion in the DR are those related to temperature management, such as air conditioning and electrical heating.

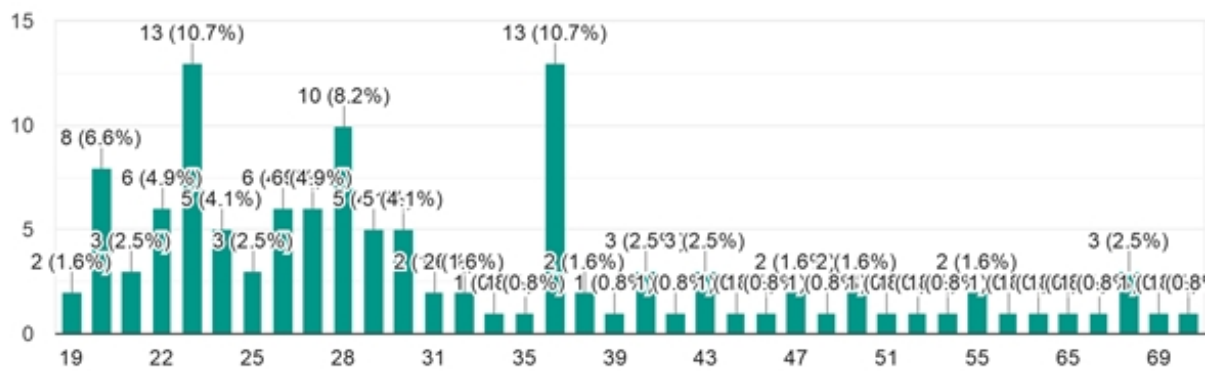
Finally, appliances that show the least potential for inclusion in the DR are those related to cooking and hot water usage. Such appliances are: ovens, cooking tops and electrical water heaters. This also applies to refrigerators/freezers, in cases when communication with the supplier/aggregator is not conducted entirely in the background, but users have to make decisions based on messages from the system (e.g. postpone opening of the refrigerator/freezer or not).

# Appendix: Results (Figures)

The following 19 figures present questions and responses of the conducted questionnaire on energy usage in households.

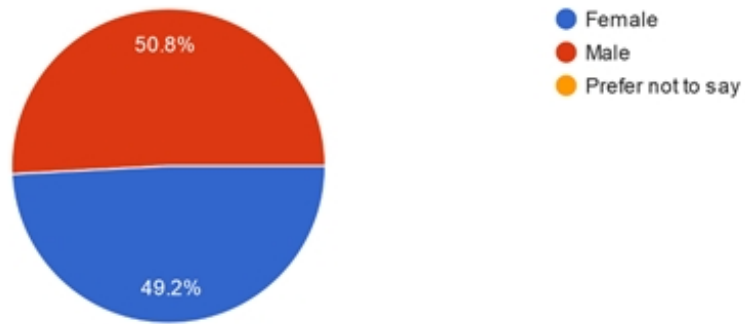
## 1. Age

122 responses



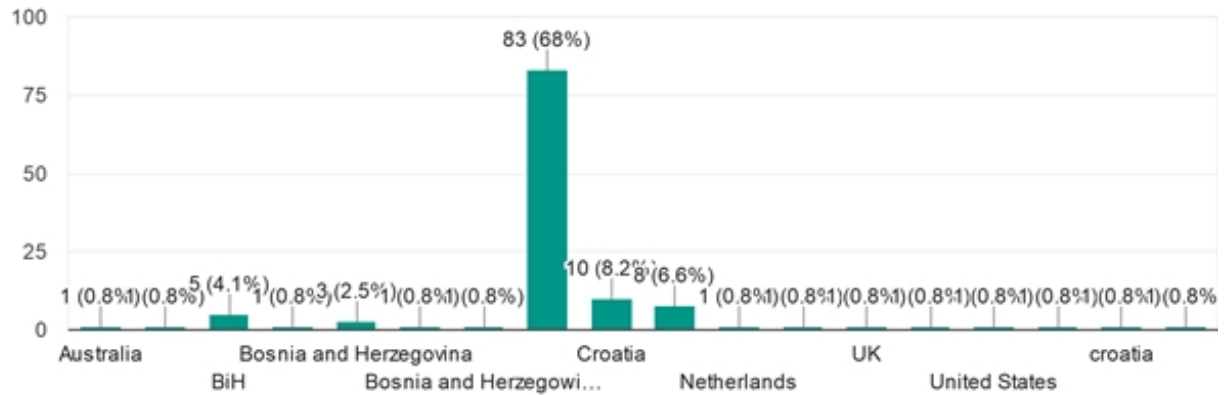
## 2. Sex

122 responses



## 3. Country of residence

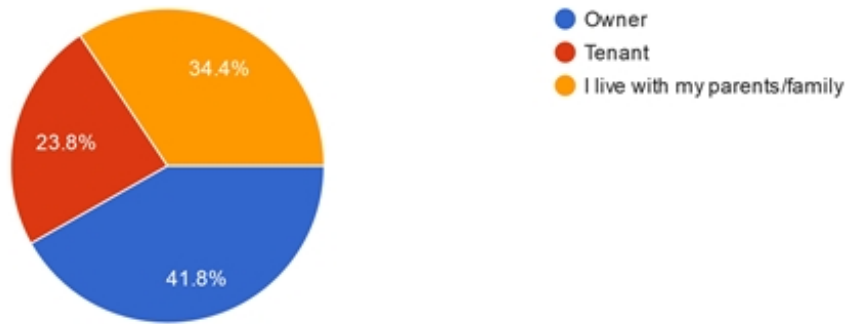
122 responses





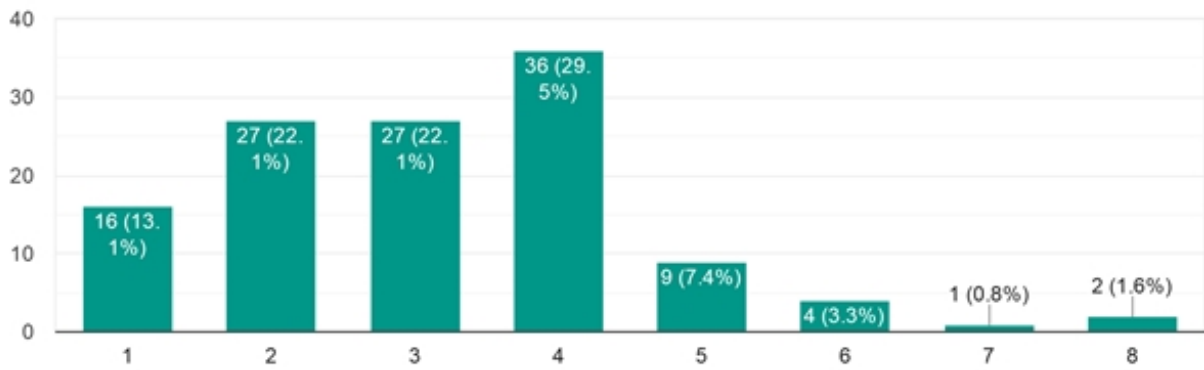
#### 4. Do you own the object in which you currently live or are you a tenant?

122 responses



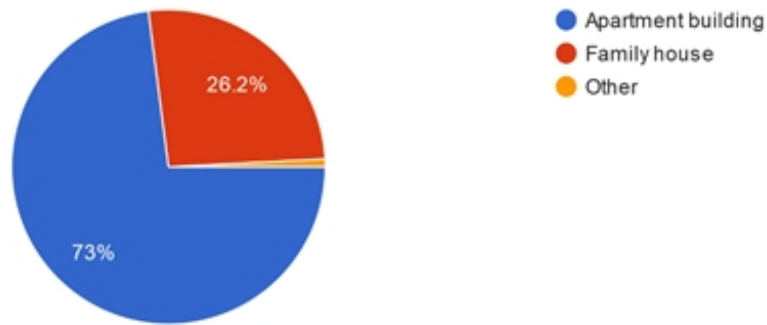
#### 5. How many members live in your household?

122 responses



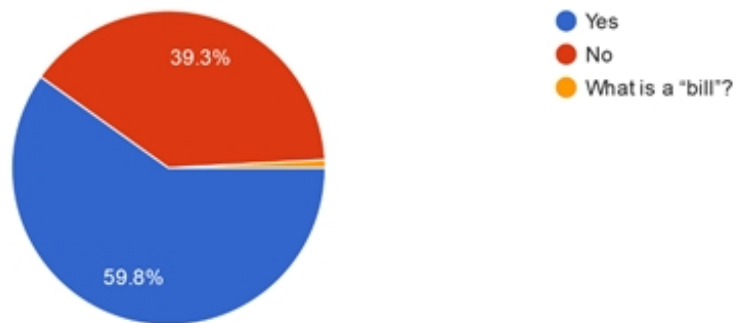
6. Do you live in an apartment building or a family house?

122 responses



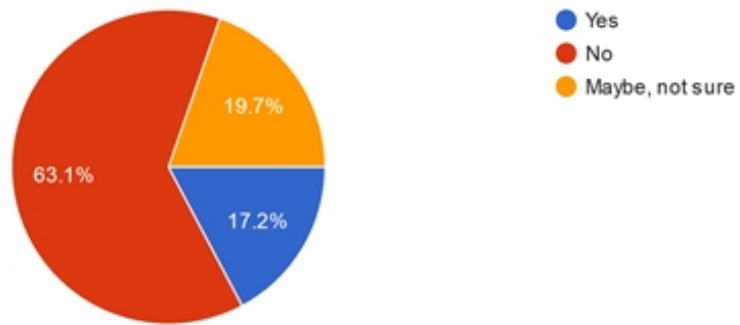
7. Do you keep track of your electricity bills?

122 responses



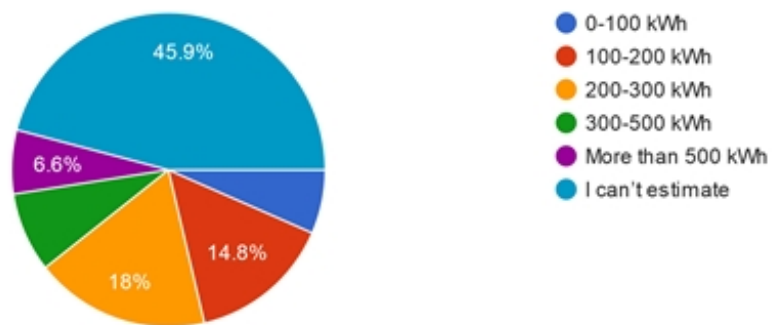
8. Do you think your electricity bills are significantly burdening your home budget?

122 responses



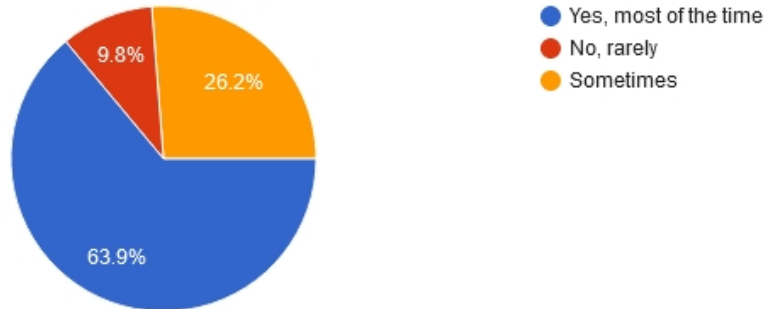
9. Can you estimate how much electrical energy you consume monthly in kWh?

122 responses



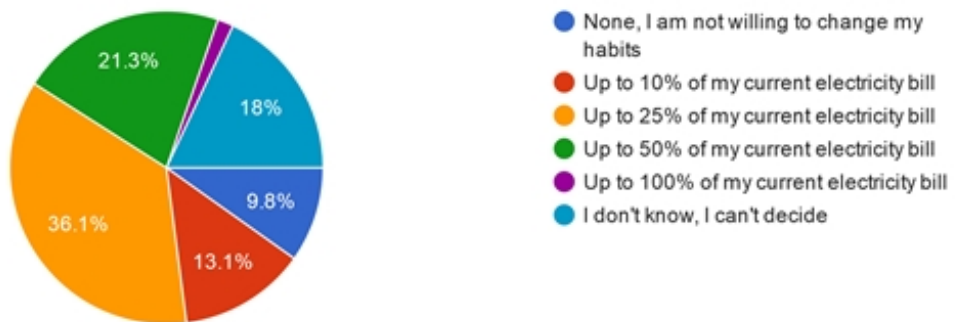
10. Do you actively try to reduce energy consumption and your electricity bills? E.g. by making sure you always turn off the lights when they are not in use, by washing the laundry in the period of low-price energy, etc.

122 responses



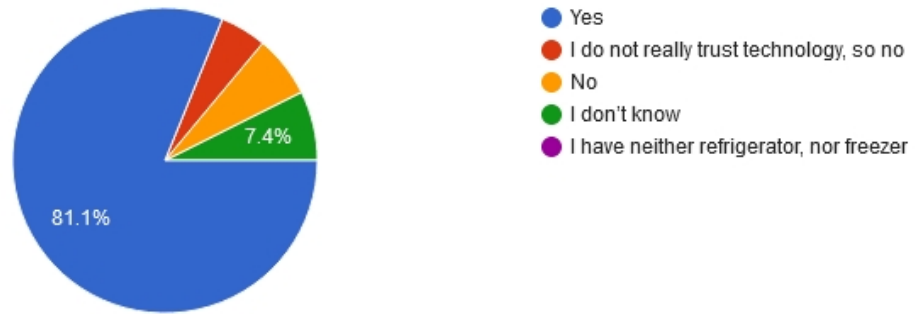
11. Which amount of financial compensation would be enough for you to change your habits regarding usage of household appliances?

122 responses



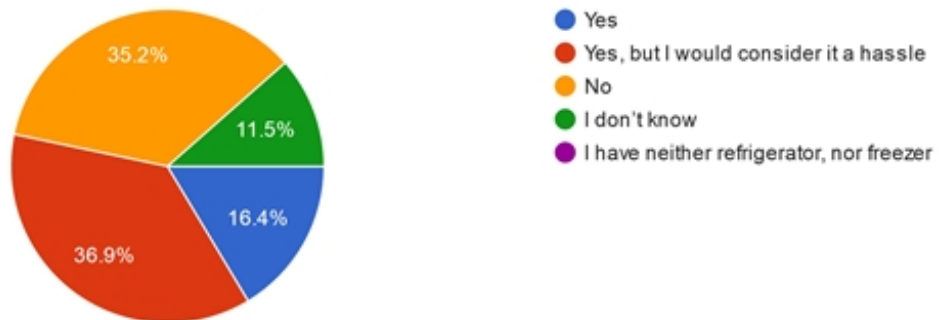
12. Would you include your refrigerator/freezer in an automatic demand response program for a certain fee? Refrigerator/freezer would be controlled by a smart algorithm and nothing would change neither in the way you use it, nor in the quality of the grocery storage (cooling).

122 responses



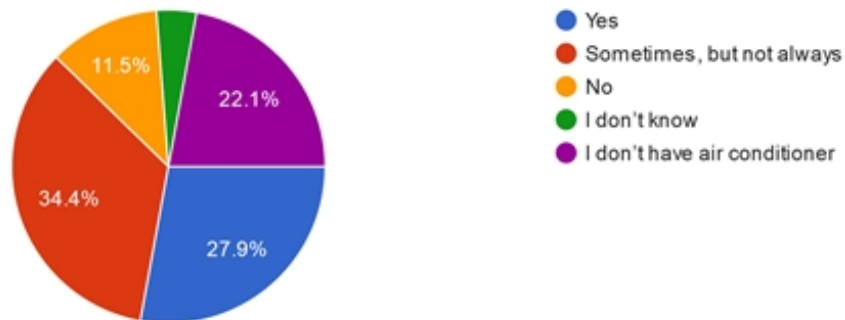
13. Would you be willing to postpone opening your refrigerator/freezer for a certain fee? This would be indicated by a message from your supplier/aggregator.

122 responses



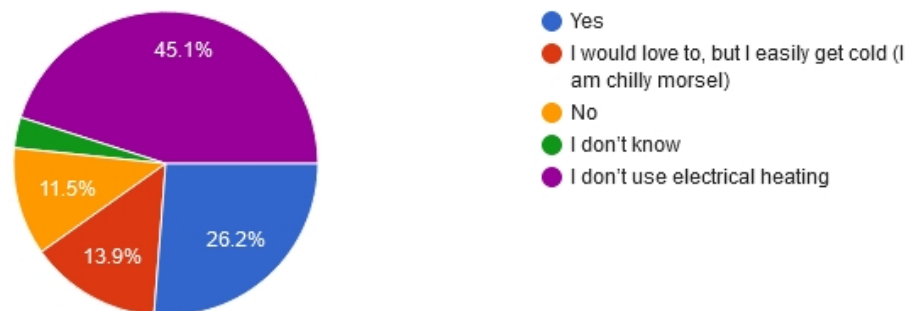
14. In case you are using air conditioning in your home, would you be willing to slightly increase the temperature at a request from your supplier/aggregator, in return for a fee?

122 responses



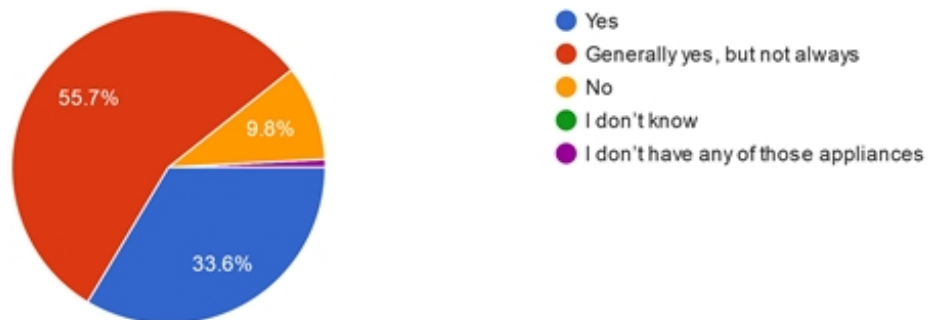
15. In case you are using electrical heating in your home (electrical heaters, heating through air conditioner, etc.), would you be willing to slightly reduce the temperature at a request from your supplier/aggregator, in return for a fee?

122 responses



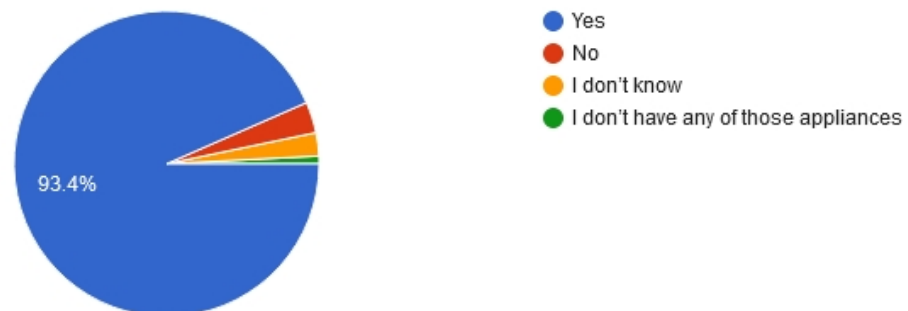
16. Would you be willing to postpone usage of your washing machine (and/or tumble dryer and/or dishwasher) based on a message from your supplier/aggregator?

122 responses



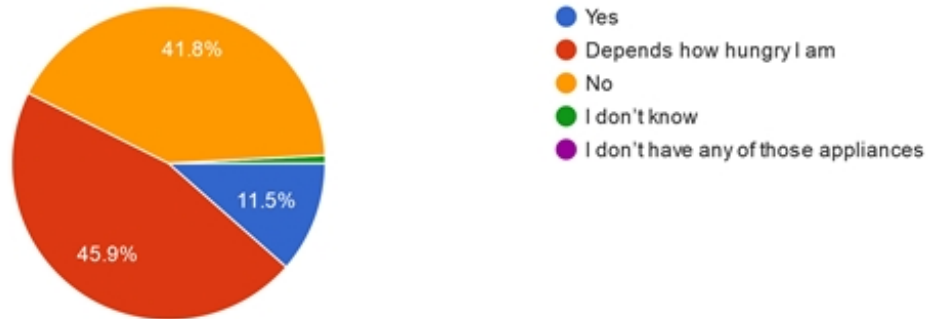
17. Once your washing machine (and/or tumble dryer and/or dishwasher) has been loaded and ready to start its program, would you be willing to set a time frame in which you want it to finish and then let a smart algorithm do the rest?

122 responses



18. Would you be willing to postpone usage of your cooking appliances (oven, cooking top) based on a message from your supplier/aggregator?

122 responses



19. In case you have electrical water heater(s), would you be willing to postpone usage of hot water (showering, washing dishes) based on a message from your supplier/aggregator?

122 responses

