



Deliverable 3.1

REPORT ON FINDINGS FROM CONSULTATIONS AND ONLINE-SURVEY

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D3.1: Report on findings from consultations and online-survey

Summary

This deliverable presents the stages of preparation and construction of the research tool serving, together with the consumer segmentation included in D2.3, to obtain the necessary information on the behaviour of end-users that will be used to build the eco-bot model. In addition, this report contains the results of research carried out among customers of eco-bot partners who will later participate in testing the functionality of the application. Also due to the need to revise the assumptions for segmentation of energy consumers for the project's needs, this report presents a modified concept of segmentation on which the second empirical study was based.

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- ☐ PP = Restricted to other programme participants
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List of Acronyms and Abbreviations

CAWI: Computer-Assisted Web Interview

D: Deliverable

WP: Work Package

Executive summary

The purpose of this report is to present the individual phases of the empirical research carried out as part of the WP3 eco-bot project and present its results. The content of this report forms the first stage in the construction of an individual model of energy consumer behaviour. The aim of the report is, among others, to describe the construction of the research tool, to present an analysis of the outcomes of the preliminary and the main survey together with preparation of preliminary assumptions and conclusions for building an individual model for the eco-bot application.

The WP3.1 phase of the project has been divided into 4 individual stages, which were presented in the report.

1. The initial phase of the research. This phase concerned the conduct of a preliminary survey for the purpose of testing and evaluating the tool to be used in the basic study, using the chosen questionnaire technique.
2. The first empirical research. The second stage comprised the collection of results and their in-depth analysis.
3. Modification of segmentation. In the third stage of the research the necessary changes were made and the characteristics of new eco-bot segmentations sectors tailored to the needs of the project were presented. This stage completed the development of a new research tool for both individual and commercial consumers based on modified assumptions and new approaches to segmentation.
4. The second empirical research. The final stage was a synthetic analysis of the results of the second empirical research, presenting the results in a graphical way and drawing the main conclusions that form the basis for building an individual model for the needs of the eco-bot project.

Main results and conclusions:

I Insights from Triandis TIB to eco-bot model

The Triandis model was used in research on the eco-bot behavioural model primarily to gain a comprehensive understanding of what determines the behaviour of energy consumers. For the purposes of the eco-bot project, the assumptions of the Triandis model became the basis for creating a model of consumer behaviour due to the emphasis on the importance of habits in individual energy consumption. Therefore, during the process of creating an individual model of energy consumers' behaviour for the purposes of the project the questionnaire survey included questions and answer options taking into account the following determinants of behaviour: needs and desires; attitudes and preferences; habits;

learning process/level of awareness and knowledge; personal and economic factors; social factors, especially reference groups and the influence of the family.

II. Main results from preliminary survey

The preliminary survey, conducted in the opening workshop in Barcelona and at the University of Economics in Katowice, Poland consisted of two parts: a proper questionnaire containing the substantive aspects of the study and a survey to the questionnaire. The main objective of the survey was to check the adequacy of the planned type of research - use of a questionnaire; correctness of formulating questions and the accuracy of instructions for respondents. In addition, the aim of the research was to determine the duration of the study and to obtain information on respondents' reactions to the presented research issues and the method of measurement. The obtained test results indicated the need to significantly change the design of the research tool (among others they indicated the need to resign from open questions) as well as the need to shorten the overall survey. All suggestions of respondents were taken into account when constructing the proper questionnaire. Thus, the purpose of the preliminary survey was achieved.

III. Outcomes from the main research:

During the study, two questionnaire surveys were carried out. In each field study (among the residential and commercial consumers), the research sample was selected in a targeted manner, in accordance with the assumptions of the non-random selection of the respondents' sample. The purposive sampling method was chosen. Both studies were conducted among the clients of the consortium partners in the countries that will participate in the pilot phase of eco-bot application.

The first study was conducted using a standardized CAWI method exploiting a questionnaire form for individual and commercial users, described in section 4 in this report. The survey prepared for the needs of the eco-bot project consisted of two types of questions. The first group was the segmenting questions constructed on the basis of the market segmentation of private households adopted by adelphi, based on in-depth literature studies and described in detail in report D 2.3. The survey results showed that the respondents were mainly classified into two categories: Green-advocate energy savers (49,4%) and Traditionalist cost-focused energy savers (37%). The second group of questions included in the questionnaire were questions that should contribute to the characteristics of the consumer in particular segmentation sectors. However, the obtained results from the first survey, were not sufficient to properly build a stable consumer classification model. With weak data (too many incomplete returns and too few returns altogether), the model will show an error rate of almost 50% - (the error rate can be compared with the results of the theory of probability - 1 out of 2 respondents will received wrong recommendations in the future). In addition to ensure correct operation of the model, the training set should contain all the options possibly existing in the examined reality. As the results of surveys of segmented questions show, the proposed segmentation does not

fully reflect all foreseeable options of consumer beliefs and motivations hence, the initial segmentation was adapted on the basis of empirical findings and it was decided to repeat the survey.

The second research similarly to the previous one was also carried out using a standardized CAWI method exploiting a questionnaire form for individual and commercial users, described in section 7 in this report. The survey on both individual and commercial customers was repeated. However, after receiving the results of surveys of commercial clients the concept of the need to build behavioural model for business clients was re-analyzed taking into account the practical approach resulting in needs of these enterprises. Due to the fact that the declared behaviour of the respondent representing the organization does not translate easily into actions focused on more effective energy management undertaken in the organization itself it was decided that this type of clients would be divided according to other criteria that would be more relevant to the sector's specificity and needs.

When it comes to individual consumer research an adjusted segmentation of eco-bot clients has been developed. The authors distinguish 5 consumer segments: Ecological Idealist (EI); Aspiring Ecologist (AE); Dedicated Saver (DS); Opportunist (O) and Indifferent (I). The distribution of respondents' answers were fairly regular which shows that the assumptions were selected in such a way as to anticipate all potential responses and to best reflect respondents' thinking in the context of ecological problems. Moreover, the thesis that individual consumers do not show motivation to pro-ecological behaviour related to home improvements or to increasing the value of their households has proved successful. The results show also that clients assigned to particular sectors differ in the degree of ecological awareness and the intensity of financial motivation.

Links with other WPs

The results obtained at this stage of the work on the project and described in this report will be used in phase WP3.2 in order to create an individual behavioural model for the users of eco-bot and to develop recommendations tailored to the appropriate consumers segments. Moreover, the information received in this phase will form the knowledge base and content in WP4. In addition the results of the research and the functioning of the model will be used for preparing and publishing scientific articles, promotion of the project at national and international conferences and for educating energy consumers in the consortium partners' countries.

1. Introduction

The eco-bot project aims at increasing energy consumers' engagement towards sustainable energy consumption. To achieve this goal, it is necessary to create a model of individual energy consumer behaviour based on the results of behavioural studies combined with the analysis of data obtained from smart metering and other sources.

Considering the sphere of consumption and its individual elements, including rationality of consumer behaviour, it should be noted that individual elements of this system are mutually intertwined with each other and simultaneously they build a multilaterally linked system with the external environment. The actions of various determinants cause changes both in the level as well as the structure of consumption. Considering only non-economic factors related to the shaping of individual attitudes and resulting mainly from their personality traits, the adopted system of values, motives, emotions, rules of conduct can be seen in purchasing activities of individual characteristics of each consumer.

Therefore, it is extremely important to know the needs of consumers, the level of electricity demand and the changes in consumer attitudes. Hence, an useful skill is to predict the behaviour of energy consumers and their assessment. As behavioural economics indicates, the behaviours of entities on the market are not always fully rational and cannot be explained and evaluated using only the methods applied in the main paradigm of modern economics.

The first step in the implementation of objectives set by the eco-bot project is to conduct appropriate empirical research on a selected sample of energy consumers, so as to obtain information on the habits, behaviours, attitudes and motives of consuming energy. This information will be used to build an individualized behaviour model, which will become the basis for an appropriate segmentation of current and future clients of energy companies, platform and service providers and, consequently, will be necessary to develop personalized advice and recommendations using a designed IT assistant.

The design and objectives of this report have been fully subordinated to achieving this goal. The deliverable is divided into nine chapters. Chapters 1 to 3 present the introduction, the aim of the deliverable and the methodology. Then the report is divided into two main sections, which contain detailed descriptions of the implementation phases of the eco-bot project in the scope of task 3.1: the phase of building the tool and analysis of the results of the conducted research. Chapter 4 begins with indication of insights from Triandis TIB to eco-bot model and short description of reasons for carrying out the survey on energy consumers. Next, the chapter contains a description and main conclusions of the carried out preliminary survey, which served as the experimental field for the preparation of a proper research questionnaire. The chapter ends with a detailed description of the constructed research tool: a questionnaire for both individual and commercial consumers. The tool was created on the basis of literature studies; experiences of authors from

previous research; conclusions and recommendations resulting from reports from phase 2 of the project (Deliverable 2.1; 2.2; 2.3), together with discussion and consultation with project partners, both in the form of exchanging e-mails and in the group discussion during tele-conferences. Chapter 5 is entirely devoted to the analysis of empirical research conducted among individual and commercial consumers, this chapter also contains preliminary conclusions regarding the construction of a behavioural model as well as limitations resulting from the received data. Chapter 6 presents a description of the new approach to consumer segmentation, contains criteria, factors and current trends in consumer behaviour as well as reasons for the need to modify the segmentation for the purposes of the project. Also in this chapter, the assumptions of the new segmentation on which the empirical research was based are described. In the next chapter - 7 a re-description of the revised research tool is included. Moreover the necessary changes and the expected results are described. Chapter 8, on the other hand, contains the analysis of repeated empirical studies in terms of assumptions about the project's objectives. This chapter characterises the most important results and conclusions that will be used to build an individual model for the application. This chapter was divided into four parts, in which the following were described: characteristics of the research sample, results of segmenting and sensitive questions for the model for individual consumers as well as results of research in the commercial sector. The final section (chapter 9) concludes with a summary of outcomes.

2. Aims of this deliverable

The assumptions and layout of this report are subordinated to the implementation of the objectives of the eco-bot project in the WP3 phase. At the same time, this report and its content are forming the first stage in the construction of an individual model of energy consumer behaviour. Implemented during the next stage of the project phase of task 3.2 it will constitute a substantive integrity due to the need to use the empirical data that are necessary for building the model.

The aims of this deliverable are as follows:

1. Analysis of the results of the preliminary survey in order to make the necessary corrections and modifications into questionnaire form and also provide explanatory insight into the behaviours of hypothetical end-users
2. Presentation of the results of analysis, discussion and consultation with partners on the construction of an appropriate research tool - a questionnaire for individual and commercial energy consumers
3. Description of the research tool used to conduct an empirical survey for individual and commercial clients together with the main assumptions of the study.

4. Presentation of the results of the conducted research through the analysis of received data from consumers identified in the target countries.
5. Preparation of preliminary assumptions and conclusions for building an individual model for eco-bot application.

3. Methodology

The structure of this report, divided into two main sections, enforces the use of different research methods. Research on energy consumption, consumer behaviour and habits is an extremely difficult and complex process. Consumer decisions are not only influenced by objective variables, but also subjective ones, e.g. routine, habits. This creates a complex need taking into account factors that affect the behaviour of individuals and households. A consumer who satisfies every day, basic needs, most often is guided by experience, customs or stereotypes. While new decisions are demanding to take a completely new, bias-free decision. Research shows that consumer choices are also influenced by such features, as: sex, age, education or income. Due to the above listed characteristics, consumers choose new products or are either cautious, or they act routinely.

Consumer preferences are also influenced by the closer and further surroundings, such as family, relatives, friends or groups with which people come into contact every day, for example at work, school or the market. Thus, the consumer is subject to wide influence from a closer environment, e.g. information, opinions heard from relatives or friends, and further surroundings. An example can be information provided by the press. It should be noted that a special role in the survey of consumer behaviour is attributed to the role groups. Their significant role lies in the fact that the consumer imitates the behaviour of people with his/her surroundings, which he/she respects, admires and with whom he/she would like to identify. That is why the consumer compares his/her own lifestyle to those social groups on which he/she cares. The sources of inspiration in meeting the needs of all kinds will be advices or preferences for example from friends and acquaintances (Maczyńska-Kowalska, 2001).

Considering the above assumptions, the authors chose a holistic approach to energy consumption research, hence the following research methods and techniques were used in the preparation of this report:

1. In the first part of the report (based on literature analysis), quantitative and qualitative methods were used. During the construction of the questionnaire, discriminate methods were also taken into account. In addition, the most important factors necessary to build the consumption model were selected. In the first part of the report, the results of preliminary

studies based on a non-random method using the accessibility of the respondents were analyzed. The auditory method was used and the respondents were examined using a standardized questionnaire with the participation of the assistant researcher. Next, an analysis was made of the results which were discussed in the team and among the partners and then the synthesis of the results was made. On this basis, questionnaires for main research were created.

2. In the second part of the report, the data was analyzed and the results of research were compared with the existing cases from the literature. Due to the results obtained, the assumptions of the survey were also transformed and a modified segmentation of the energy consumer was presented. Then the questionnaire form was revised and a new survey tool was prepared, taking into account changed factors. Finally, a synthetic analysis of the results of the re-examination was made, based on scientific induction methods and the results of the research were graphically illustrated.

4. Preparation of the research methodology and tools

4.1 Insights from Triandis Theory of Interpersonal Behaviour to eco-bot model

Creating an individual model of energy consumers' behaviour for the needs of the eco-bot project, the authors of the report analysed in depth the existing behavioural models and theories of consumer behaviour in the literature (see results in report D.2.2). Trying to consider the most important factors affecting behaviour change, the Triandis TIB model was chosen as the basis for further consideration.

Reasons for choosing the Triandis model, among other existing behavioural models, for the purposes of the eco-bot project:

1. The Triandis model was used in research on the eco-bot behavioural model primarily to gain a comprehensive understanding of what determines the behaviour of energy consumers.
2. **TIB covers all aspects of Theory of Reasoned Action (TRA) and The Theory of Planned Behavior (TPB) models, and also includes additional elements that increase its predictive power, like habits, facilitating conditions and affect (Limayem et al., 2004; Woon and Pee, 2004).**
3. **Thus, Triandis model goes beyond the schemes of other models by adding habits and the presence of facilitating conditions that enable or impede the performance of**

specific behaviour (Milhausen, Reece and Perera, 2006). It includes roles, self-image and interpersonal agreements that are not included, e.g. in the Fishbein model (Robinson, 2010). Which is extremely important for the proper creation of the eco-bot energy model.

4. For the purposes of the eco-bot project, the assumptions of the Triandis model become the basis for creating a model of consumer behaviour due to the emphasis on the importance of habits in individual energy consumption. Individual behaviour is very important, including those resulting from habits that contribute to sustainable or unbalanced energy consumption. The way users use household appliances is extremely important in shaping future consumer attitudes and in seeking to influence their behaviour. Some consumers are characterized by a certain lack of knowledge, low awareness and temporary commitment to saving energy, while they are accustomed to performing specific permanent activities during daily functioning as well as to a certain lifestyle. Habits and routine are extremely difficult to change. It can be seen that consumers often declare their desire to reduce energy consumption, but at the same time they show no effort to change their behaviour and habits. Paying attention to the importance of routine activities in energy saving, continuous education of consumers as well as indicating good practices or benefits resulting from changing behaviour is the goal of creating the eco-bot application. However, without knowing the opinions, motivations and consumer habits it is not entirely possible. Therefore, the inclusion of elements of the Triandis model in the course of research and the creation of a survey on this basis has become extremely important for the correct construction of the energy customer behaviour model. To be sure that all the most important factors affecting the behaviour of application users have been taken into account, this model will also be checked and evaluated by users in the pilot phase of the project. A correctly applied model of consumer behaviour can help ECO-BOT to carry out the appropriate segmentation of the consumer, as well as determine the scope of information needed to create an appropriate strategy of communication with the customer/energy consumer. Considering consumer behaviour allows better understanding of their needs and forecasting future decisions.

5. During the process of creating an individual model of energy consumers' behaviour for the purposes of the project, the assumptions of the Triandis model were taken into account and hence the questionnaire survey included questions and answer options taking into account the following determinants of behaviour (for a more detailed analysis of factors see sections 4.4.2 and 7 of this report):

- a) **needs and desires** - desires are a manifestation of a specific direction to meet the needs. On the other hand, motives direct consumer behaviour - they are a force that creates consumer behaviour towards achieving the desired state (equalizing the difference between the current and expected state).
- b) **attitudes and preferences**. Beliefs can be shaped by consumers based on: knowledge, opinions, emotions or faith. Attitude, on the other hand, reflects the assessment of behaviour (favourable or unfavourable), emotional feelings, ideas,

religion, politics, fashion, music, diet, etc. The attitudes of consumers towards certain behaviours are the same, biased. A well-established attitude conditions the feeling of a well-made decision and eliminates the process of thinking and re-making decisions.

- c) **habits** or past behaviour represent prior consumer learning. In the Triandis model, there is a compromise between habit and intentions taking into account the learning process. Triandis defines habit as *"situation-behaviour sequences that are or have become automatic.... The individual is not usually 'conscious' of these sequences."* (Triandis 1977, cited in Darnton 2008). Moreover the TIB measures the frequency of past behaviours, but the habit is activated by a system of tips triggered in response to a situation or environment. Triandis explaining the importance of habits refers directly to Pavlov's Theory of Classic Conditioning (Triandis 1977; Darnton 2008).
- d) **learning process/level of awareness and knowledge.** This process leads to the modification of beliefs and attitudes as a result of acquired experience. Attitudes, preferences, beliefs, habits and images are shaped in the learning process. The consumer remembers experience from previous periods related to income, prices, needs, reference group requirements, changes in preferences as a result of years arriving, etc.
- e) **personal factors** that determine consumer behaviour, such as: number of people in the household, dominant age group in the household, lifestyle, education, profession.
- f) **economic factors - consumer income**
- g) **Social factors**, especially reference groups and the influence of the family on consumer behaviour. Reference groups have a direct impact on the behaviour and attitudes of individuals. Groups of which the entity is a member or with which it enters into are called member groups. The family is the most influential reference group. This situation changes depending on changes in the environment, e.g. culture, country or social class.

4.2 Reasons for carrying out surveys on energy consumers

Consumption is the process of satisfying diverse and permanently changing human needs, including all forms of consumer behaviour related to the acquisition and use of goods and services, conditioned by economic, cultural, social and psychological determinants. The use of natural resources and environmental protection are largely determined by value systems, preferences, choices, behaviours and activities of households. Patterns of consumption are manifested in models and patterns of everyday human life: in attitudes and choices regarding work, consumption, leisure time, education and investment, as well as consumer's environmental awareness (Rumianowska, 2014).

Ecological awareness is a complex construct consisting of many components. It consists of views, knowledge, ideas about the environment and established attitudes and behaviours of individuals towards the natural environment. According to Edyta Sidorczuk - Pietraszko and Alicja Zawistowska (2011, p. 51-52) three levels – (units of ecological awareness) analysis can be distinguished:

- The first level - the global level, which is shaped by global economic, technological and political decisions (international protocols, laws and environmental pollution resulting from the global economy). The influence of individuals on the processes taking place at this level is negligible, remains in the hands of the decision-makers, and the changes take place spontaneously, without anyone's intervention.
- The second level creates an intermediary mesostructure between the individuals and the highest level. It is an environment closer to the single unit (neighbourhood, commune), having a greater impact on its ecological condition.
- The third level diagnoses ecological orientations of individuals. The main methodological problem is to establish the relationship between the opinions expressed and the actual behaviour of the respondents.

The objectives of the eco-bot project are related to the research on energy consumers' behaviour at the third level of analysis. Determining the true behaviour of consumers is particularly sensitive when the interview tool is an interview questionnaire (survey), the conclusions of which are based only on the respondents' declarations, rather than direct observation of their behaviour. There is therefore an area of uncertainty about whether and when the information provided will be reflected in the activities.

As Elisha R. Frederiks, Karen Stenner and Elizabeth V. Hobman (2015, p. 1385) note, consumers are increasingly aware of the value and demand for sustainable energy practices and climate change issues. They emphasize that there is often a significant discrepancy between consumer knowledge, values, attitudes and intentions declared by consumers, and their observable behaviour. In addition, in reality people react unexpectedly, not in accordance with rationality. The dissonance between attitudes and behaviour can have several sources. First, it increases when the questions addressed to the respondents refer to different levels of detail. For example, a positive answer to a question about such a general issue as care for the state of the environment does not necessarily correlate with the fact that the respondent sorts the garbage or saves energy. Secondly, commitment and awareness are important. Being part of an ecological organization, having a lot of knowledge about it, or being interested in this issue increases the likelihood that declarations will translate into activities. An important factor is also the time that elapsed between measuring the attitude and the behaviour of the subject - the longer it is, the greater the discrepancy (Sidorczuk - Pietraszko & Zawistowska, 2011).

Behavioural economics and psychology can be very useful in understanding consumer behaviour in the energy market and help consumers to use renewable energy and

sustainable energy consumption. The usefulness of behavioural economics methods was also indicated by the studies of Donal Clancy and Deirdre O'Loughlin (2002) or by Stefanie Lena Hille (2016), which proved that energy saving people, except for the propensity to save and ecological awareness, are also characterized by features such as high aversion to consumption and interest in investing in energy-saving technologies. This includes the evidence that energy suppliers should put more emphasis on offers that provide consumers with more tangible benefits for energy saving behaviours (Clancy & O'Loughlin, 2002, p. 258). Moreover, as Eri Nakamura (2016) points out consumer activities, including energy saving intentions, are more the result of behavioural rather than rational, physical factors (Nagaj, 2018).

Many human activities are not thought out. Instead of engaging cognitive forces to process many of the information needed for rational behaviour, in practice in many situations people use heuristics, thought patterns, act automatically and habitually. Therefore, it is necessary to conduct empirical research that allows learning about human behaviours, habits and motives. Due to the limited time and the possibility of conducting individual interviews in the eco-bot project, it was decided to use the questionnaire survey to determine the assumed objectives of the study. Questionnaire surveys are currently one of the most popular ways of collecting information during scientific research. It is a complex process requiring both knowledge of the research methodology and the availability of appropriate analytical tools. However, in order to conduct this type of research in a reliable way, it should be considered conducting a preliminary test - a preliminary survey in order to be able to test the prepared research tool, refine it and, if necessary, modify it accordingly. The initial research is carried out at the preparatory stage of the questionnaire, and, like the trial tests, they almost exclusively pursue the "substantive" objective: they serve to refine the research concept and the set of applied indicators. The eco-bot team decided to conduct such a study, the results of which were presented in the following sections of this report.

4.3 Report on Preliminary Survey

4.3.1 Preliminary survey - basic assumptions and functions

The preliminary survey is a type of preliminary research and aims to test and evaluate the tool to be used in the basic study, using the chosen questionnaire technique. The tool is checked for its suitability to provide information sought by the researcher. In principle, everything can be checked from the type of sample selection, methods and research tools to the order of questions in the questionnaire or interview.

In the preliminary survey it is most often checked whether the proposed method of measuring the phenomenon, i.e. the formulation of questions in questionnaire, with a

specific wording and structure, provides information that may become the basis for substantiated conclusions.

The reasons for which the question does not bring reliable material, and in this sense are flawed, may be various, e.g. occurrence in the question of logical errors or terms ambiguously understood, excessive irritability of questions, etc. It would be ideal if the preliminary survey would accurately indicate the flaws of the question, and also gave instructions on how to edit them, to be authoritative, and finally provide tools to make this clear (Grzeszkiewicz-Radulska, 2012 p. 113-114).

According to Leszek Gruszczyński (1999, p.101), the preliminary survey tasks include:

1. Verification of the research problem including answering the following questions:
 - does the research problem occur in the studied population?
 - has it been properly operationalised?
 - whether the indicators fulfil their function, or the concepts have the same empirical sense, or
 - whether the research problem can be solved with such a research technique.
2. Verification of the research tool which consists of:
 - evaluation of the questionnaire and individual questions for establishing contact between the researcher and the respondents,
 - assessment of questions in terms of usefulness to solve the problem,
 - checking whether the questions are tailored to the respondents' ability,
 - checking the relevance and relevance of the answers,
 - assessing the comprehensibility of the question and adequacy cafeteria (helpful statements included in "Other. What? ..."),
 - determining whether the open-ended questions used in the questionnaire could be replaced with closed ones,
 - analysis of questions and answers in terms of their completeness, checking how many questions remained unanswered;
3. Defining the organizational and technical aspects of the study:
 - checking the time of research (including arrival, contact with the respondent, completing the questionnaire),

- verification of the survey,
 - estimation of the list of inaccessible units,
 - checking how to reach the tested and testing sites, determining costs, checking networks of interviewers;
4. Preparation of the collected empirical material: preparation of a code instruction, decisions on result sets, coefficients and statistical tests.

Moreover during the preliminary survey, it is necessary to check not only the research procedure, sample selection and specific questions, but also the answers given by the respondents. There may be a situation in which a seemingly simple question will provide extremely different answers, proving that everyone understood them differently.

4.3.2. Conclusions and main results of the preliminary survey for the eco-bot project

4.3.2.1. A summary of the main conclusions from the focus group in Barcelona

During the opening workshop that took place on 4 December 2017 in Barcelona, three interviews were conducted with utility customers to check the questionnaire prepared by KAT, as well as to obtain additional information. The interviews were based on a previously prepared standardized interview questionnaire, the questions of which were read out to the participants of the focus group by the members of the eco-bot. The responses were recorded in the questionnaire with additional notes. It was not a full preliminary survey due to the small number of participants. The basic results of the study and conclusions are summarized in the D2.1. (ANNEX B of the D2.2 also provides a template for the questionnaire).

After analyzing the results of the interviews, the members of the KAT team decided that despite obtaining relevant information during the survey, it is necessary to conduct a proper preliminary survey on a sample of at least 100 people covering individual energy consumers. It was decided that such a study would be carried out in Katowice, Poland (due to time and costs). The purpose of the preliminary survey is to construct a universal tool that will be used in the main study. The preliminary test checks the utility of this tool and looks for any errors or gaps, hence the testing of this tool can be carried out in any country and the results can be used in the main study in all pilot countries. It was also decided that

the current interview questionnaire will be modified and improved accordingly with feedback from respondents.

Members of the KAT team also decided that there is no need to conduct preliminary surveys on other user groups (commercial consumers), because the purpose of this study is to best construct questions about the motives, habits and behaviour of consumers, which mainly concerns individual energy consumers.

During the workshop in Barcelona, a questionnaire consisting of two parts was used:

- the main part of the questionnaire included questions regarding the study of consumer behaviour
- the second part included questions regarding obtaining opinions on the questionnaire design

After analyzing the obtained answers, it was decided that in the next survey the second part of the questionnaire will remain unchanged, while the first part will be significantly changed. The second part of the questionnaire included questions about the respondents' understanding of the questions and commands contained therein; shortages or errors in the survey; opinions of respondents on the number of open questions in relation to closed questions as well as the number of all questions in the survey. The respondents could also express their opinion on the whole survey and put their comments suggestions and concerns there.

The following conclusions were drawn from the responses of part two:

- there is a need for a more detailed explanation or reformulation of some of the questions
- the number of open questions is sufficient or slightly too large
- some of the questions are unnecessary and can be removed from the form
- there are no questions that segment consumers' energy behaviour
- the number of questions in the survey is optimal and should not be increased
- the survey should be done again to test the questionnaire on a larger number of respondents and also to get information about the time the form was filled in by the respondents.

In connection with the above, the KAT team refined the questionnaire of preliminary surveys and made the following changes:

- the following questions were completely removed from the survey: 1,5,6,9,11,14,16,17,18,19,
- the questions about chat-bot characteristics were removed because the survey focused mainly on issues identifying consumer behaviour
- some of the questions have been reformulated, e.g. 3, 20

- questions that segment consumers' energy behaviour have been added
- a question about energy saving motives has been added
- a question regarding the frequency of receiving information on energy efficiency has been added
- the demographic profile was expanded.

The full new questionnaire of preliminary survey can be seen in ANNEX A.

4.3.2.2. The results of proper preliminary survey conducted in Poland – March/April 2018

A preliminary survey on consumer activities and behaviours affecting sustainable energy consumption was carried out from March 15, 2018 to April 10, 2018 in order to verify the prepared research instrument. It was additionally performed outside the planned activities of the WP3 of the project. The survey selected 150 representatives of households located in the Śląskie Voivodeship (Poland). The preliminary study was conducted using a non-random method based on the accessibility of the respondents. The study was conducted using the standardized auditorium survey method at the University of Economics in Katowice in three rounds. A total of 107 questionnaires have been returned, which places the return of the preliminary survey at 71.3%. The research was aimed at determining the readability of the structure of the prepared questionnaire, the level of understanding of individual questions and verification of their necessity. The questionnaire was distributed by a member of the KAT team who, after the examination, prepared a report on the course of the preliminary survey. The full questionnaire of preliminary survey can be seen in ANNEX A.

Among the respondents, 65.5% were women, 28% men, and 6.5% of respondents did not indicate gender. The largest group of respondents was aged 18-25 (45.9%) followed by 30-45 (39.1%). The largest group were representatives of 4-person households (35.1%). Also the most, as many as 79.4% of respondents indicated that they live with their families, only about 1% of respondents answered that they live alone. Most of the respondents indicated that they live in a house (45.8%) or an apartment (39.2%), which they own (56.1%) or rent (10.3%). Most respondents described their economic situation as good (49%) or neither good nor bad (30%). Only 4% of all respondents described their situation as bad or very bad altogether.

The preliminary survey was a conventional pilot project consisting of two parts: a proper questionnaire containing the substantive aspects of the study and a survey to the questionnaire. It carried out was treated as a preliminary study of a differentiated form, where the main objective of the study was to check:

- Adequacy of the planned type of research - use of a questionnaire
- Correctness of formulating questions,
- The accuracy of instructions for respondents.

The pilot survey provided answers to the following questions:

1. Have the best methods, tools and research techniques been used? Is the questionnaire correctly selected?
2. Are the questions structured in a comprehensible and legible way for the person completing the questionnaire?
3. Did the respondent actually understand the questions?
4. Did the respondent understand the task the researcher set for him?
5. Did the respondent understand the key terms included in the question?
6. Did the respondent understand the alternatives included in the cafeteria? Does he/she differentiate them and is he/she able to choose one of them?
7. Is there a problem with using the respondent's card - does the respondent want to use it?

The preliminary survey was not intended to check the selection of the sample - as the proper study will be based on a targeted sample established in accordance with the objectives of the eco-bot project. It is assumed that the population for preliminary surveys should count a minimum of 5% of the main population to be tested, which has been met in this study. In addition, in order to get the results of the preliminary study as soon as possible, the authors have also decided to change the method of the survey. The proper research was planned in the form of a standardized online survey - CAWI, while the preliminary study was carried out in the form of a standardized auditorium survey in paper form.

In addition, the aim of the research was to determine the duration of the study and to obtain information on respondents' reactions to the presented research issues and the method of measurement. In the preliminary survey, authors decided to extend the scope of the study in order to collect additional opinions and judgments that would help in the construction of an appropriate questionnaire. On the one hand, the preliminary survey should be as close to the basic research as possible, but on the other hand, it should provide all information that will help to improve it. Using the open questions contained in the preliminary survey, the authors set up detailed information from respondents regarding:

1. Reasons for the respondents of not controlling electricity consumption (question 2)
2. Respondents' opinions on factors encouraging to plan energy consumption and start saving energy in the household (question 3)
3. Reasons for changing the heating/cooling system in the household (question 5)

4. Opinions of respondents on barriers preventing saving energy (question 6)
5. Opinions of respondents on what is the single most effective thing that you could do to use less energy in their lives (question 7)
6. Respondents' motives for energy-saving behaviours (question 11)
7. Time devoted to contact the energy supplier in the last 12 months (question 12)
8. Reasons according to respondents not to use the form of chat bots for better energy management in homes (question 14)
9. The kind of information that the respondent would like to receive from the chat-bot assistant regarding energy (question 17).

The analysis of the collected empirical material should not be limited to its quantitative dimension, but it can be supplemented - in the available scope - with a qualitative analysis. Contrary to common methodological opinion, both types of qualitative and quantitative analyses are not competing with each other, but are complementary. In this way they should be treated from the point of view of maximizing the cognitive goals of research. In addition, qualitative research goes beyond standard focus interviews associated with them, individual in-depth interviews, interpretation of biographical materials or participant observation.

In reference to the present research, the qualitative analysis is based on the explanatory understanding procedure, which seeks to penetrate - through the combination of simple empathy and exploration of social and economic conditions, which constitute the context of a given research situation and the studied subject - in the behaviour of energy consumers - representatives of households (opinions declared by the respondents in their answers to the questionnaire). The basic general question, which requires the use of this procedure, concerns the causes of specific opinions (both expressed and those inarticulate) in the subject matter and the confrontation of three types of these declarations:

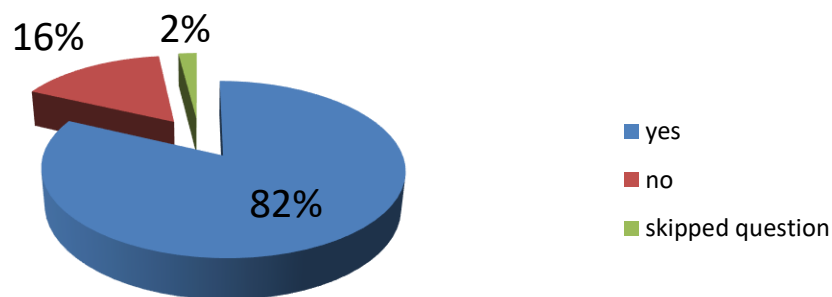
1. Relating to motives that encourage study participants to save energy
2. Relating to actions taken (or not) by the respondents regarding energy saving
3. Referring to respondents' attitudes regarding the hypothetical interaction with the assistant's chat

The collected research material is diverse, which means that it does not deviate from the norm established by the methodological experience of research practice. However, some of

the questionnaires were filled in negligently, superficially, with many questions omitted altogether (mainly concerns open questions), often without much involvement in the proposed analysis and interest in the possibility of expressing their opinion, in three cases there were not filled almost at all. However, there are surveys that are precisely and carefully filled, with clear concern of respondents for comprehensive answers, and even those in which the scope of information provided goes beyond the expectations of the authors of the research.

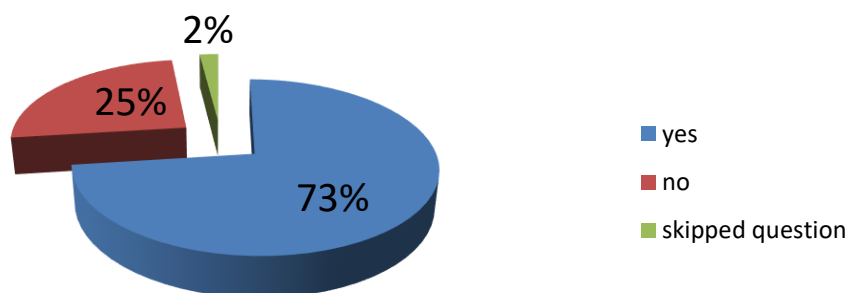
Results of the survey and specific comments on the responses are provided below.

Q1. Do you know how you can optimize your electricity consumption?



This question mainly serves as an the introduction and indicates information about the level of the respondent's knowledge. It provides a soft approach to the questionnaire and should be included in the main survey.

Q2. Do you control your electricity consumptions?



This question is an important question but maybe it should be reformulated so that the researcher can get more detailed information on the methods of controlling energy consumption and its optimization by the respondents.

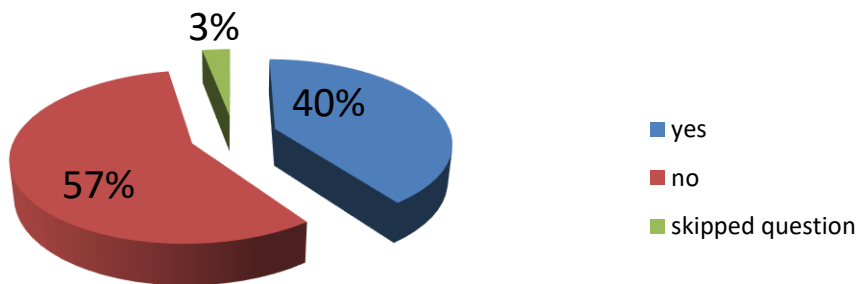
In the preliminary survey in question 2, respondents, who indicated the answer no, were also asked for the reasons for the lack of control of energy consumption. This was the first open question contained in the survey. As much as 85% of respondents who do not control energy consumption explained their reasons in the survey. The main reasons indicated by the respondents are mentioned below:

- I don't feel the need because I don't pay the bills
- I spend a lot of time at home – so I have to use electricity appliances all the time
- I don't pay the bills, so I don't check it
- I don't need it
- I don't care
- Nobody demands it
- I have not been taught how to do it
- I am not interested in
- Somebody else does it
- Lack of knowledge how to do it
- I don't have time to do it
- I don't know how much energy I use daily
- I forgot.

Question 3 of the form was as follows: What factors would most encourage you to plan your energy use and to start saving energy in your household?

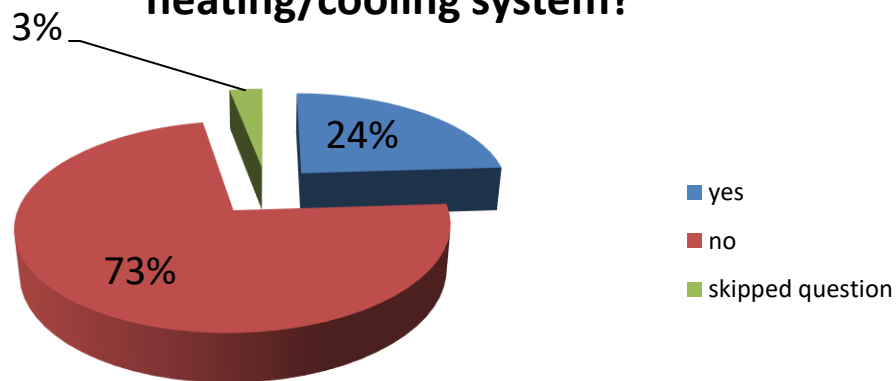
Only 57% of respondents answered this question. This is a very important question that should be included in the main study, because ecological behaviours result from various premises. For respondents, the reasons are mainly pragmatic. The results convince rather of rational, individualistic motives and factors encouraging to reduce energy consumption. Most often mentioned were too high bills for energy or financial factors as well as the impact of media campaigns encouraging to save energy or the occurrence of local programs supporting saving in the form of subsidies or loans for changing the heating system into a more ecological one.

Q4. Do you feel social pressure to control or to reduce your electricity consumptions?



This question seems to be important in the light of the responses received. It should be included in the main study because it shows the influence of social groups or its lack on consumers' decisions and behaviour.

Q5. Did you ever change your heating/cooling system?



This question, like question number 2 in the survey, includes the extension of the affirmative answer, among others, to the number of system changes made by the respondents. During the last 5-15 years, the respondents changed the system once (11 indications) or twice (8 indications). 6 people did not indicate the number of changes. In

addition, respondents mainly pointed to: too old and inefficient previous system; willingness to reduce energy costs; moving home or renovating an apartment and changing to a more efficient source of energy as the reason for system changes. 31% of respondents did not state the reasons for changing the system. This question is also combined with question 3 of the preliminary study on factors to save energy. It should be combined and reformulated in order to obtain more detailed information.

Question 6 of the form was as follows: Based on your opinion, what are the barriers of your engagement towards increasing energy savings?

Unfortunately, only 43% of respondents answered this question. Among all indications, we should mention the seven most common ones:

- Lack of knowledge,
- Bad daily routines (laziness, absentmindedness)
- Financial barriers
- Poor mentality of people
- Too low energy cost
- Lack of time
- Low social responsibility

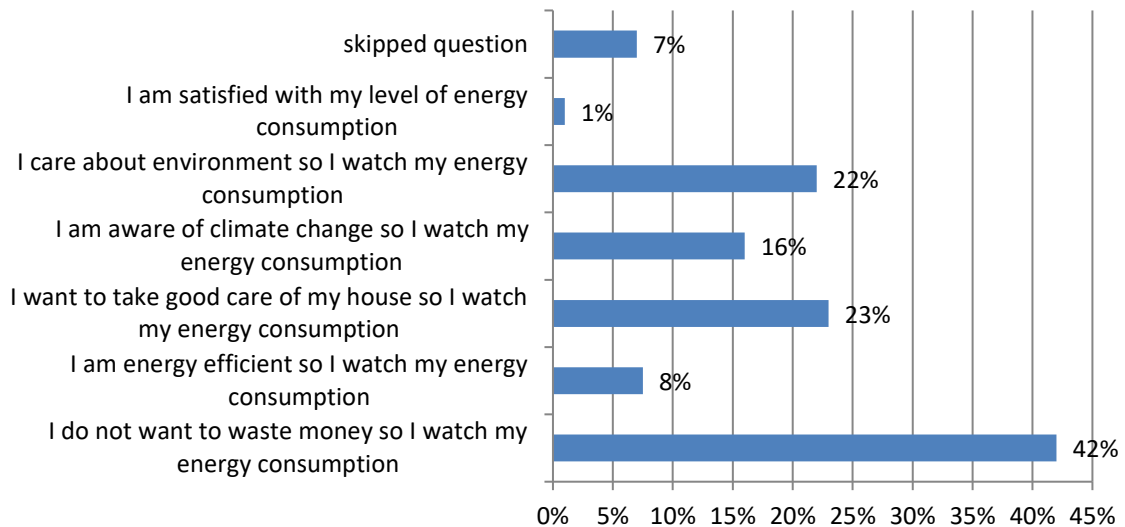
These answers will be used in constructing the main research questionnaire.

The basic determinant of ecological attitudes is everyday behaviour. Everyday habits are more stronger than general attitudes and sometimes they are opposite to the believes or thoughts on the environment. **In question 7 respondents were asked about:** What is the single most effective thing that you could do to use less energy in your life?

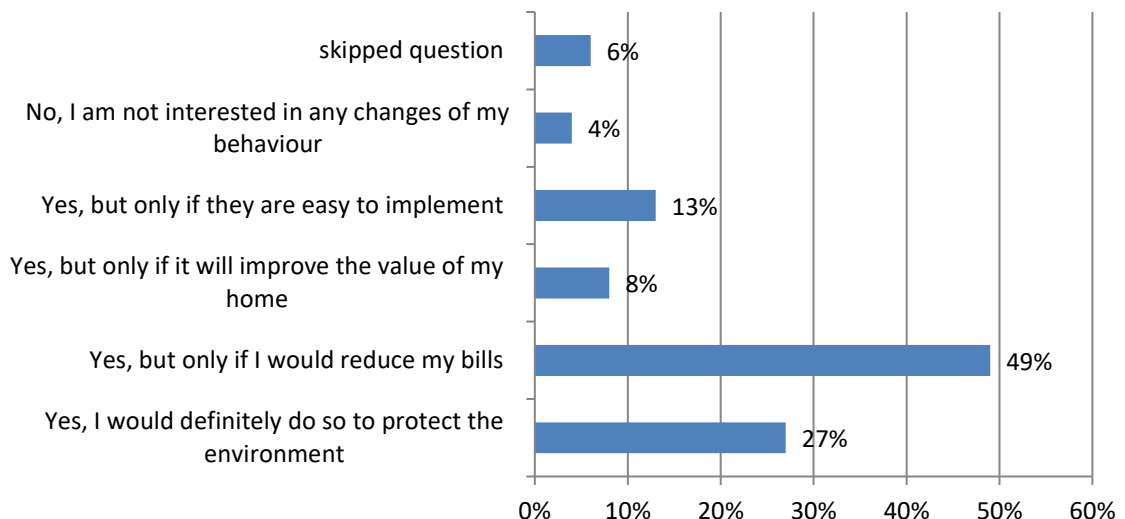
Over 58% of respondents answered this question. The most popular answer indicated by the respondents was switching off the light when nobody is in a room or when there is no longer a need to use it. The respondents also pointed to the necessity of switching off or not using unnecessary electronic devices. Some of the respondents also indicated the replacement of devices with a more energy-efficient one, or replacement of lighting for LED bulbs. The other answers are:

- Not using the electricity to heat the house
- Use public transport instead of cars
- Changing habits e.g. going to sleep earlier
- Investment in solar panels

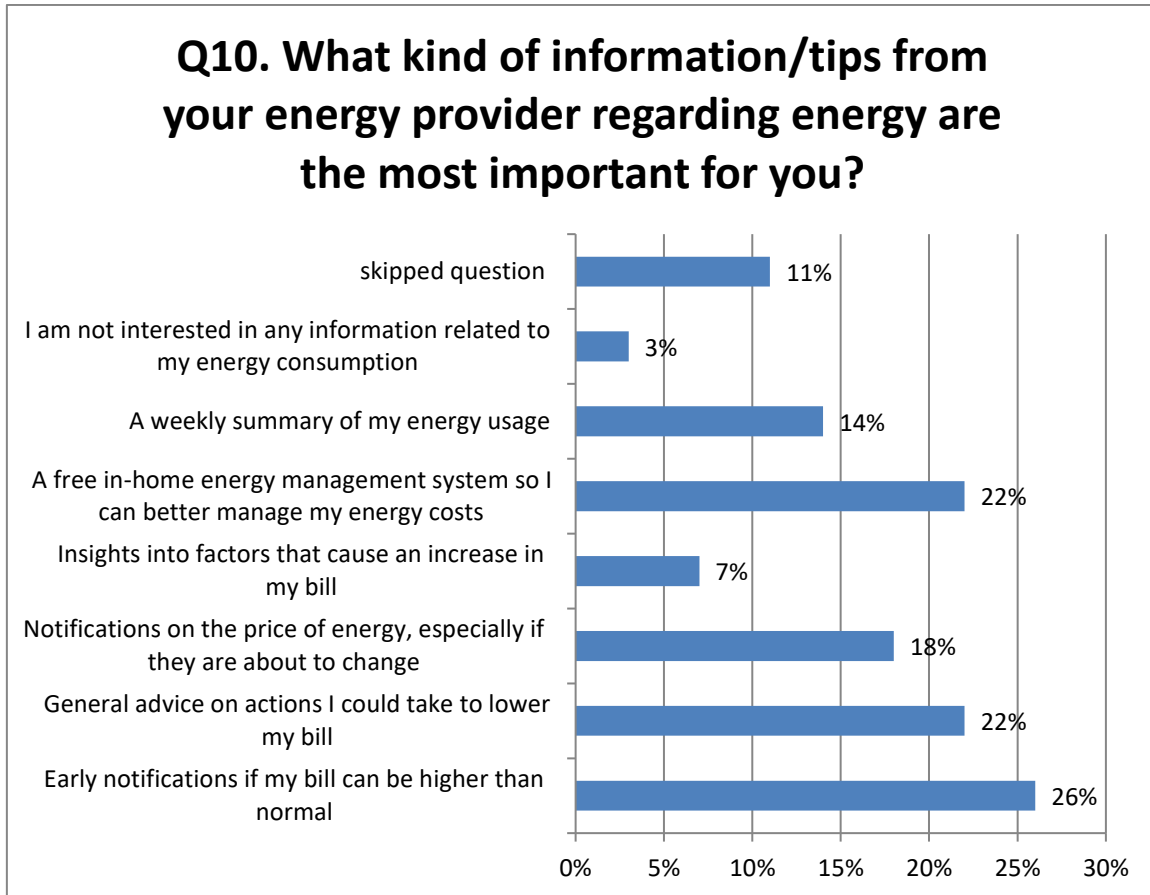
Q8. Which of the following statements you can most relate to?



Q9. Would you be interested in adopting energy saving measures if they would require change of the behaviours in your household?



Respondents' answers in questions 8 and 9 do not add up to 100 because the respondents indicated more than one answer. These questions are used to segment clients and because the answers are very diverse, they fulfil their role in achieving the assumed goal.



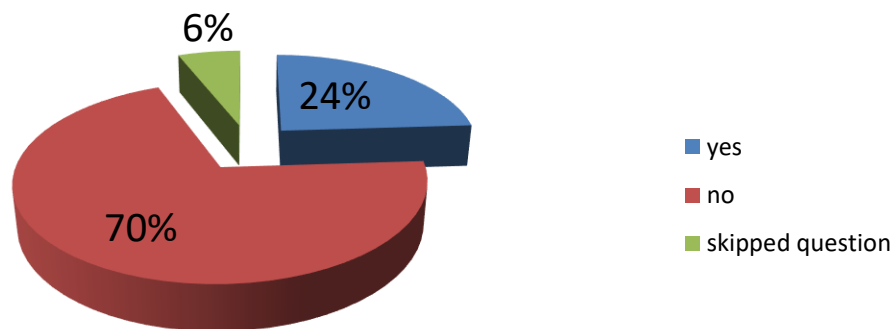
This question seems to be important and provides a lot of information, but it will be more appropriate to use in the survey for commercial users and not for individual consumers of household representatives where the main purpose of the research is to obtain information on the behaviour of the respondents. The information contained in this question can be however obtained from other sources. Hence, this question will not be included in the main survey?

Question 11 asked participants in the preliminary survey about energy saving motives. Of all open questions included in the form, the largest number of respondents answered that question - up to 80% of the respondents. Most often, as the most important motivation for saving energy, the respondents mentioned lower charges for electricity or saving money only on the second and third place there were community motivations - better condition of the environment and saving energy resources. The other respondents' answers concerned mainly the desire to protect the landscape. However, there are also very sporadic answers suggesting that the respondent does not care about saving energy, is not

interested in it or does not see any factors that would motivate him/her to save energy. The answers to this question in the questionnaire will be used during the main studies.

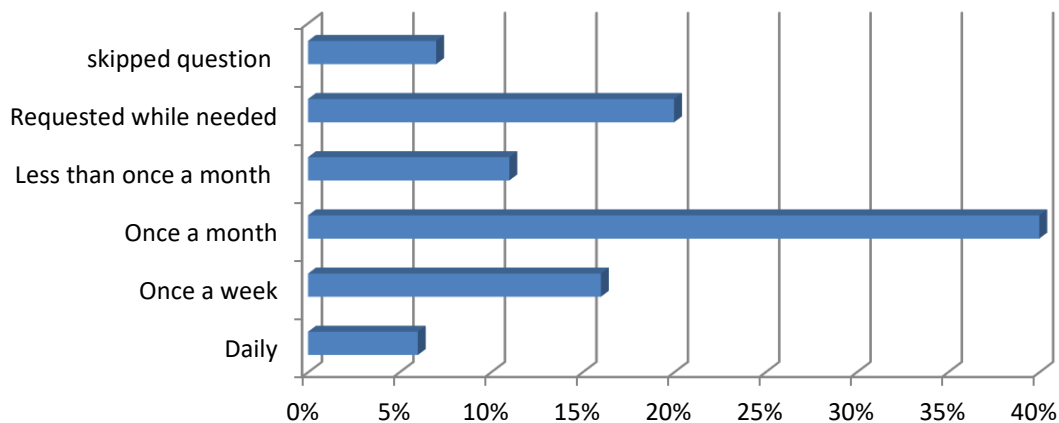
Question 12 contains the answers regarding the time devoted to contact with the energy supplier in the last 12 months by respondents. Only 43% of respondents answered this question but the answers varied widely from never, through 10-15 minutes to 1 to 3 hours up to twice a year. There were also answers that it is difficult to say or I don't know. Moreover the respondents had the most problems understanding this question, hence it will not be included in the next study.

Q13. Did you have any Web and/or mobile interactions with a representative of your energy provider?



In the preliminary survey, the authors wanted to check if the respondents have any IT experience related to obtaining information on their energy consumption. In the extension of question 13, what seemed interesting, 27% of respondents with such experiences indicated that they considered digital experience with their energy provider as more difficult than interacting with other types of providers. Nevertheless the answers of question no 14 show that more than 74 % of respondents want to use a chat bot tool to help manage their household energy. Only 8% of the respondents did not answer this question. However, the reasons why the respondents did not want to use the chat bot are different. The main reason is that they preferring individual contact, their fear of sharing personal data or the lack of such a need.

Q15. How often do you want to receive information about energy efficiency from the chat assistant?



This question, like question 10, does not refer to consumer behaviour, so in the main study it is worth considering changing or reformulating the question so as to obtain information about the respondent's attitude to modern technologies.

Question 16 concerns the demographic profile which was briefly discussed at the beginning of this subsection.

Question 17 is the last open and final question in the first part of the survey. The authors wanted to know **what kind of information the respondents would like to get from the chat bot tools regarding energy**. Most respondents would like to obtain information about their bill or daily energy consumption. Some want to get advice on how to reduce energy use or information about energy price changes. In addition, the respondents wanted information on modern technologies that can help to save daily energy usage. Only 37% of respondents answered this question.

Main results and conclusions:

1. The average time of completing the questionnaires was: 20 minutes. The shortest time to complete the survey was 10 minutes and the longest 35 minutes.
2. Most respondents declared that the questions are understandable to them.
3. Out of 107 completed surveys: 3 surveys were not completed almost at all, only 20 respondents completely filled in the survey. Most respondents did not fill open questions -

on average 41% of respondents did not answer these questions. The least number of fills concerns question 17 where only 37% of respondents gave answers. Lack of completions of the entire questionnaire may indicate that it is too long, too complex and contains too many open questions.

4. In addition to the opinions received from the preliminary questionnaire, we also collected respondents' comments on the survey design, some respondents declared that the number of questions was too high, some respondents pointed to too many open questions, a small percentage of respondents would introduce minor changes to the order of questions. All suggestions of respondents were taken into account when constructing the proper questionnaire. In addition, the respondents indicated the need to clarify the initial information for information about the project, which could be corrected.

5. The analysis of the answers shows that the questionnaire in the modified version (see analysis of changes to the relevant questionnaire in next part of this report) is able to collect the necessary information for the implementation of the objective set by the eco-bot project

4.4 Preparation and construction of the relevant main study questionnaires

4.4.1 Potential issues with online surveys

Internet usage in market research dates back to the 90s of the last century. As in the case of other fields using the Internet, as in the case of research, provided researchers with new opportunities and potential acceleration of obtaining research results. Of course, using the Internet in market research is not without flaws. Potential issues remain the subject of discussion and require researchers who decide to use Internet-aided research tools to take remedial and preventive actions. As it was decided that the on-line survey will be the most appropriate tool for the purpose of the eco-bot, the advantages and disadvantages of this solution were presented in the table no. 1.

Table 1: The advantages and disadvantages of an online survey

Source: based on Poynter, 2011; Mazurek, 2008; Gunter et al., 2002; Tingling et al., 2003.

Advantages	Disadvantages
<ul style="list-style-type: none"> • cheap in implementation, • the data received is easily quantifiable, • shortening the research process, 	<ul style="list-style-type: none"> • technological limitations • frequent self-selection of respondents, • possibility of multiple filling by one user,

<ul style="list-style-type: none"> • reduced risk of making mistakes when answering or coding, • the possibility of supplementing the questionnaire with multimedia additions, • the respondent has full control over the process of completing the questionnaire, • less risk of falsifying responses to meet the interviewer's expectations, • potentially larger geographical coverage of the conducted research, • ease in modifying the test tool before conducting the test. 	<ul style="list-style-type: none"> • lack of representativeness of Internet users' population for the general population (impact of digital exclusion), • anonymity (depending on the chosen option - confidentiality and anonymity may be more difficult to provide), • the fear of respondents for improper use of the given data, • shorter time spent on answers, • no direct contact with the respondent, • no possibility to assess the respondent's behaviour while completing the questionnaire, • decreasing number of Internet users willing to participate in on-line surveys.
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In the case of research conducted for the needs of eco-bot modelling purpose, some of the problems common in the case of Internet-based research tools, e.g. sampling, automatic selection of respondents or appearance of "professional respondents" (Poynter, 2011) will be eliminated by referring to a specific group of people - users of services provided by the project partners.

In the case when the invitation to participate in a survey is sent via e-mail or other medium that identifies the participant (like logging in to the website), the following problems must be noted, which may negatively affect the low rate of returns from respondents (Ranchod & Zhou, 2001): no anonymity, technological and programming problems, the risk of identifying a message inviting to participate in the survey as a spam and blocking the possibility of sending messages to clients of a given postal service or the risk that respondents will introduce changes to the questionnaire (Karcz & Bajdak, 2004).

Properly preparing the research tool allows eliminating some of the disadvantages of this solution, e.g. early contact with potential respondents will reduce the risk of treating a message containing an invitation as spam. The preparation of an online survey in the form of the website automatically removes some of the mentioned disadvantages. For example, it is easier to ensure the anonymity of respondents in the case where the invitation to participate contains only a link to the page where the questionnaire is located - the respondent does not have to provide his or hers e-mail address or login credentials. In such situation finding out which respondent completed the form is difficult, which depending on the aim of research may provide undesirable from the perspective of the researcher. In the case of the eco-bot modelling purpose there is no need for identification of respondents as the survey aims at obtaining data that will be used for model calibration for further use.

Research conducted on the reasons for avoiding filling in on-line questionnaires by online users drew attention to three main factors affecting the number of people avoiding taking part in completing the form or resigning while filling in the form. These are (Althoff & Macelrov):

- the length of the questionnaire, both in terms of the number of questions and the time required to complete it,
- the level and type of benefits expected by the respondent to complete the survey,
- level of involvement, or to what extent participation in a given study can be perceived as entertainment or an intellectual stimulating activity.

Taking into account those indications, the final questionnaire prepared for the needs of eco-bot should: not require from the respondent more than 7-10 minutes to fill, be interesting and informative and offer benefits to the respondent (e.g. in the form of the potential tool/service that will be better suited to the individual needs).

Taking into account potential disadvantages of using the internet questionnaire and trying to prevent errors that could significantly affect the results, much attention is paid to the proper construction of the research tool. The most frequent non-random errors in the case of surveys (also in the case of an online survey) belong to one of following categories (Szreder, 2011):

- error caused by the lack of respondents' answers,
- measurement error,
- error in processing the collected statistical data.

The risk of errors in the study can be reduced by following certain principles of designing an online questionnaire. Principles especially relevant for the survey aimed at gathering data suitable for the eco-bot modelling purpose are presented in table 2.

Table 2: The principles of designing an online questionnaire aimed at the reduction of errors in the study

Source: based on Karcz & Bajdak, 2005.

Designing principles	Type of error	
	measurement error	caused by the lack of answers
The questionnaire should be initiated with a welcoming motivational screen which emphasizes the ease of answering questions, presents the goal and the initiator of the research, and instructs how the respondent should go to the next page of the questionnaire.		X
First question should be interesting to all respondents, easy to answer and completely (without scrolling) visible on the screen.		X
If possible, the questions should be presented in a manner analogous to that normally used in traditional questionnaires printed on paper.	X	X
The colours should be used with moderation (subdued colours or a traditional arrangement of black letters on a white / neutral background), in order to maintain the readability of the questionnaire, as well as not to influence the way of answering questions.	X	
Avoid solutions that result in differences in the appearance of the questionnaire (table formatting, collapsing lines of text) in various screen configurations (resolution and colour depth settings), operating systems, web browsers or devices (especially important for mobile devices).	X	X
Provide instructions on how to answer the questionnaire, as well as other necessary instructions in places where they are needed (if it cannot be automated).		X
The drop-down lists (if needed) should be used sparingly and with the default "select from list" type label.	X	
However tempting for the researcher, a response should not be forced by preventing respondent from moving to the next question before answering the previous one.		X
Instructions for filling survey should be designed and explained in such a way that before responding to another part of the questionnaire the respondent should answer the	X	

filtering question.		
If the number of variants of the answer to the question exceeds the number that can be displayed in one column in the window, consider arranging them in two columns, remembering to clearly separate the two columns.	X	
It is advisable to use graphic symbols or other type of indicator to show the respondent the progress in answering surveys questions.		X
It is advisable to avoid questions that are known to cause problems for the respondent, i.e. open questions, a civic cafeteria allowing the respondent to choose at least two given answer options.	X	X

Proper design of the questionnaire significantly affects its return rate, however, the researcher may also apply other techniques to attract a larger group of respondents. Techniques affecting the level of return, not directly related to the survey design, include, among others (Wiley et al., 2009): frequency of contact with the respondent, the right motivation, survey through prior contact or information campaign, personalization of correspondence/contact with respondents, a strict statement about the respondent's anonymity and assurance about the security of data provided by him or her, providing a reliable e-mail address in order to enable potential contact with the researcher, affiliation of the research institution.

Taking into account indications from the literature and the principles of preparing questionnaires, as well as the conclusions from the preliminary survey, the proposal for the proper questionnaire according for the eco-bot modelling purposes was prepared.

4.4.2. Individual consumers survey form: questions and expected results

Using the results from the preliminary questionnaires and good practices in the field of questionnaire design, questions have been developed that aim to obtain information allowing segmentation of end-users for the needs of eco-bot in accordance with the report D2.3. MARKET SEGMENTATION MAPPING CONSUMERS' NEEDS TO THE TAXONOMY MODEL.

At first, the respondents will be informed about the purpose of the research, the potential benefits and why their contribution of the information on energy behaviours is important. Ensuring anonymity and voluntariness, as well as the possibility of verification of the institution conducting the research will be included in the welcome screen.

Questions relevant for segmentation of end-users

According to the good practices the first, introductory question/questions should be simple and interesting for respondents in order to encourage them to take part in the survey. During the preparation of the survey form different types of questions and their order were taken into consideration. There were questions that had to be asked as they were relevant for the segmentation proposed in D2.3 report and some that would allow for the characterisation and clustering of the end-users. Unfortunately every additional question which was adding to the length of the questionnaire and the amount of time needed from the respondents was also increasing the risk of respondents abandoning the survey before providing information needed for the modelling purpose. As the result it was decided that the first question will already concern information relevant to the user segmentation process.

Question no. 1. (Instruction: Please select only one answer)

- Do you own or rent the place you are currently living at?
- a. Own
 - b. Rent

This question was suggested in D2.3 report as relevant for obtaining the information about the ownership of the flat/house, which influences end-users' **authority to buy** one of the factors needed for segmentation. It is an important factors as some recommendations (e.g. about thermalisation or window replacement) will be of no use for the end-users if they are renting a house and the owner will not agree to it. It is a rather simple question and it concerns topic that is important for the end-users: the place where they live. The next question (no. 2) starts a series about energy behaviours in a given home. As an introductory question, the respondent will be asked to evaluate the energy consumption and its cost in his or hers household.

Question no. 2. (Instruction: Please select only one answer)

- How would you describe your household energy consumption and cost?
- a. It is very high
 - b. It is high
 - c. It is neither high or low
 - d. It is low
 - e. It is very low
 - f. I refuse to answer

It is a question that probes the respondents' **awareness** of energy consumption. Taking into consideration that the respondent may not be aware about the exact quantity of the energy consumed in the household the question refers to the respondent's subjective assessment of the consumption or cost. Not wishing to discourage the respondent from answering further questions, an option allowing for refusing to answer was included. Result

from this question in connection with other responses from further questions (e.g. no. 8 or no. 12), can be potentially used to better match advice to particular user. Question no. 3 also relates to the energy behaviour of the consumer, but is specifically directed at gauging the end-users potential of saving energy.

Question no. 3. (Instruction: Please select only one answer)

How much thought do you give to saving energy in your home?

- a. A lot
- b. A fair amount
- c. Not very much
- d. None at all

The aim of question no. 3 is to judge whether there is a need to start working with the end-user from the beginning (actions and advices for **building awareness** about potential means to save energy/be more energy efficient) or if he/she already has given some thought to the issue of energy efficiency and may be given more specific advices (again combined with the results from other questions it may allow for providing a more personalized and appropriate advices for the given end-user). Taking into consideration that "thinking about saving energy" is not the same as actually "knowing what to do to save energy" question no. 4 focuses on the respondents knowledge about potential means of saving the energy without going into too much detail (that will come in further questions).

Question no. 4. (Instruction: Please select only one answer)

Do you know how you can optimize your household energy consumption?

- a. Yes
- b. No

In the same venue that "knowing what to do" is not the same as "doing it", after probing the respondents' **knowledge** of energy efficient solutions that can be applied to his or her household, question no. 5 asks about previously undertaken energy saving actions.

Question no. 5. (Instruction: Please select only one answer)

Were there any attempts to optimize energy consumption in your household?

- a. Yes [Please go to the question no. 6]
- b. No [Please go to the question no. 7]

It is also a simple question, but it allows for differentiation of the end-users – judging on the chosen answer they will be asked to further elaborate either on the previously undertaken actions (providing information about **past behaviours**) or reasons why such actions were not taken (providing information about what barriers were encountered and what may be needed to **motivate** them for making more energy-efficient choices). First the question no. 6, about past behaviours, will be described as it is more complex. The respondents are provided with the list of potential energy efficient or energy saving behaviours to help them

indicate what type of actions were previously undertaken in their households. In addition to listed actions respondents are asked to indicate how often (if relevant) such action was undertaken – in order to better judge to what extent the energy efficient declared awareness complies with energy efficient behaviours.

Question no. 6. (Instruction: Please select appropriate answer for listed actions, accordingly: 8-Always, 7-Very often, 6-Often, 5-Occasionally, 4-Rarely, 3-Very rarely, 2-Never, 1-I do not know)								
How often and what kind of attempts to optimize electricity consumption in your household was undertaken in the past?	8	7	6	5	4	3	2	1
Turn off lights and appliances when not in use								
Buy green energy from my utility provider								
Use energy-efficient bulbs								
Use energy-efficient household appliances								
Change settings on the thermostat (turning up air-conditioner in the summer and turning down thermostat in winter)								
Consume less								
Do not leave devices on stand-by								
Changing the heating / cooling system to a more efficient one								
Change of the energy tariff to a more efficient one								
Close windows before turning on or up the heating								
Boil the kettle with just the amount of water you need								
Hang clothes out to dry rather than tumble drying								
Wash clothes at 30 degrees or lower								
Spend less time in the shower, and/or use less hot water for baths								

Question no. 6 asks about **the past behaviours** (part of the behavioural evaluation from the Triandis model) and at the same time it's results may be used for preparation of the more personalized advices. As an added benefit - respondents may learn about different ways to be more energy efficient, ones that they were unaware of so far and ones that may be fairly easy to introduce into their daily routines. Adding open-ended option "Other, please specify" was pondered but decided against it as the potential problems with coding open-ended answers usually outweighs the potential gains, especially as this question provides quite an extensive list of potential behaviours (prepared on the basis of the literature review and results from preliminary surveys). Respondents who in question no. 5 answered "no" will be redirected to the question no. 7 regarding the reasons for not taking actions to save energy in their respective households.

Question no. 7. (Instruction: Please indicate the three most important reasons)
What were the reasons for not attempting to optimize electricity consumption?
a. Lack of time
b. Cost/Money
c. Scepticism (will it make a difference?)

- d. Lack of information
- e. Conflicting information
- f. Lack of adequate knowledge
- g. Other more pressing priorities
- h. Lack of practical or technical support
- i. Lack of support from family
- j. Scepticism from friends and/or neighbours
- k. Change of circumstance
- l. Change of priorities
- m. The belief that this will require considerable effort
- n. I did not think about saving energy
- o. I did not see any sense in it

Taking into account that the reasons for not taking actions to save energy may be different in individual cases and depending on the circumstances (e.g. something else may cause a lack of habit to turn off the lights when leaving the room and decision to purchase energy-saving household appliances) respondents in this question may choose up to three answers. The answer to this question no. 7 will provide information about potential barriers preventing end-users from taking energy-saving activities at their households and may be later on used to prepare more personalized advices aiming at motivating the end-user to act in a more energy efficient way. Question no. 8 concerns respondents **attitudes** (part of the behavioural evaluation of the Triandis model) and at the same time serves as a part of segmentation as proposed in the D2.3 report (**motivation**).

Question no. 8. (Instruction: Please select only one answer)

Which of the following statements regarding energy use you can most relate to?

- a. I believe that I can contribute to the quality of the environment and it motivates me
- b. I want to save money on my energy bill and it motivates me
- c. I like improving my home for years to come, keeping it up-to-date
- d. I like convenient solutions that can be applied easily and will not require me to think about them
- e. I am satisfied and do not worry about my current energy use

It should be noted that question no. 8 is a declarative question, i.e. it should be taken into account that the respondent declares how he or she would behave in a given situation, but this does not guarantee that actually standing before the described choice he or she will behave in this way. Remembering this, a question confirming and verifying the indicated answer should be placed further in the questionnaire. Question no. 9 is aimed at breaking the respondent out of thinking about energy saving measurements and at the same time should allow to obtain information about energy behaviours of given household.

Question no. 9. (Instruction: Please select appropriate answer for listed activities, accordingly: 7-Always, 6-Very often, 5-Often, 4-Occasionally, 3-Rarely, 2-Very rarely,

1-Never)							
For which of the following activities do you use your electric home appliances	7	6	5	4	3	2	1
Heating							
Cooking							
Cooling							
Ventilation							
Laundry							
Cleaning							
Entertainment							
Workshop							
Office at home							
Gardening							

Question no. 9 measures current **behaviours and habits** concerning the energy consumption in household and can be used both for characterization of the respondent and at the same time for preparing potential advices about saving energy. The next question, no. 10, is a **testing question** measuring attitudes and segmenting consumer behaviour motives. This question checks the compliance of consumer indications with the answers in questions no. 6, 7 and 8.

Question no. 10. (Instruction: Please select appropriate answer for listed activities, accordingly: 5-very important , 4-Important, 3- Neither important nor unimportant, 2-somewhat important, 1-Not important)					
	5	4	3	2	1
How important are the environmental and climate change issues for you?					
How important is the economical management of money and budget that you have?					

Measuring social pressure towards more energy efficient behaviours (part of the behavioural evaluation of the Triandis model) is the goal of the question no. 11.

Question no. 11. (Instruction: Please select appropriate answer for listed actions, accordingly: 6-Very strong, 5-Strong, 4-Neither strong nor weak, 3-Weak, 2-Very weak, 1-I do not care about social opinion)						
How strong is social (group) pressure to:	6	5	4	3	2	1
Reducing energy consumption						
Reducing bills						
Using renewable energy sources						
Reducing water consumption						
Keeping my home and garden tidy						

If social pressure can explain the reasons behind willingness to act in the area of the household energy efficiency it may be used to personalize the advice and further as motivation for end-users to change their energy behaviours. None the less such changes may require including additional information from smart metering so it is hard to evaluate its potential effectiveness at this stage of the project. Question no. 12 concerns the **attitudes** of the end-users toward energy saving measures. It is similar to the question no. 8, as it tries to assign respondent to the appropriate segment (according to the segmentation proposed in the D2.3 report) and it serves as a verification of previously chosen answers. The question is also declarative but unlike the previous one, it refers directly to the respondent (in the first person) trying to assess his willingness to take a given type of action.

Question no. 12. (Instruction: Please select only one answer)

Would you be most likely to adapt energy saving measures if they:

- a. Significantly contributed to tackling climate change
- b. Significantly reduced your energy bills
- c. Significantly improved the value of your home
- d. Were easy to implement and you would not have to think about them anymore
- e. None of the above, I am satisfied with my current energy usage

Question no. 12 together with previous answers should allow for assigning the respondent to appropriate segment. None the less for obtaining additional data about the willingness to change end-users habits toward more energy efficient behaviour and gauging the respondents willingness to invest in order to save energy, two further questions (that can be used as an ancillary for respondents' segmentation), no. 13 and 14, were included in the questionnaire.

Question no. 13. (Instruction: Please select only one answer)

Would you be interested in adopting energy saving measures if they would require change of the behaviours in your household?

- a. Yes, I would definitely do so to protect the environment
- b. Yes, but only if I would reduce my bills
- c. Yes, but only if it will improve the value of my home
- d. Yes, but only if they are easy to implement
- e. No, I am not interested in any changes of my behaviour

Assessing respondents' willingness to change habits concerning energy usage may prove useful for preparing appropriate advice about different energy saving measures that differ according to the needed effort or acceptance of potential comfort loss (e.g. creating a reflex to turn off the lights while leaving the room or changing the habits regarding the preferred night-time temperature in the bedroom).

Question no. 14 (Instruction: Please select only one answer)

Would you be interested in adopting energy saving measures if they require you to make investments?

- a. Yes, I would definitely do so to protect the environment
- b. Yes, but only if it would be a small sum
- c. Yes, but only if I would reduce my bills in the future
- d. Yes, but only if it will increase value of my house
- e. I am not interested in any investments

Again, assessing respondents' willingness to invest in order to save energy potentially may allow for preparing better and more adequate suggestions and advices for end-users. Even simple and not so costly investment like changing used light bulbs for more energy efficient may in long run allow for lowering household's overall consumption and energy bills. Question no. 15 aims at assessing the general **attitudes** of respondents towards different issues connected to energy conservation and overall state of environment. The obtained answers may provide additional verification of previously obtained responses and allow for more insight about what could motivate end-users to behave in a more energy efficient way.

Question no. 15. (Instruction: Please select the appropriate answer for listed actions, accordingly: 7-Completely agree, 6-Agree, 5-Somewhat agree, 4-Neither agree nor disagree, 3-Somewhat disagree, 2-Disagree, 1-Completely disagree)

Please indicate how strongly you agree or disagree with each of the following statements:	7	6	5	4	3	2	1
I feel capable of reducing energy use in my home							
I think about saving energy because my friends save energy							
I think about saving energy because my family encourages me to do so							
Energy savings suits my lifestyle							
Energy savings is easy							
Energy saving is now fashionable							
I think about the environment, so I feel obliged to save energy							
I am concerned about global warming/climate change							
I believe that I need to change my lifestyle to address global warming and climate change.							
I am concerned about rising energy prices and fuel bills							
It is very important to me that part of my electricity supply comes from renewable sources							
I feel motivated to save energy if I can use public aid (e.g. preferential taxes, subsidies, loans)							
I think that saving energy requires specialist knowledge							
I do not think about saving energy at all							

Taking into consideration **attitudes** and appropriate **motivation** one should not forget about providing giving thought to particular, easy to implement measures to save energy.

The question (no. 16) before the part of questionnaire concerned about respondents' characteristics tries to evaluate how possible it would be for the end-users to adapt some of the energy measures listed as examples.

Question no. 16. (Instruction: Please select appropriate answer for listed actions, accordingly: 5-Already done, 4-Very possible, 3-Somewhat possible, 2-Not at all possible, 1-I do not know)					
Are you considering using any of the following ideas to save energy in the future and if so how probable/possible it is to implement for your household?	5	4	3	2	1
Turn off lights and appliances when not in use					
Drive less and use other forms of transportation					
Buy green energy from my utility provider					
Use energy-efficient bulbs					
Change settings on the thermostat (turning up air-conditioner in the summer and turning down thermostat in winter)					
Consume less					
Do not leave devices on stand-by					
Changing the heating / cooling system to a more efficient one					
Change of the energy tariff to a more efficient one					
Close windows before turning on or up the heating					
Boil the kettle with just the amount of water you need					
Hang clothes out to dry rather than tumble drying					
Wash clothes at 30 degrees or lower					
Spend less time in the shower, and/or use less hot water for baths					
Invest in renewable energy sources such as solar panels, geothermal energy or wind energy					
Use home insulation					
Purchase energy-efficient household appliances					

Question no. 16 measures the willingness of the respondent to change their future energy behaviours and at the same time it verifies the answer given by the respondents that indicated that they undertook some attempts to save energy in the past (question no.5 and follow-up question no. 6). It can also be used for providing more personalised advices on the basis of obtained data and as an indirect benefit it may give respondents ideas about simple actions that they may take to reduce energy consumption of their respective households.

An important factor that will affect the effectiveness of the solution prepared within eco-bot project is the **attitude** of potential end-users to the **use of modern technologies**. It is especially important as the goal of the eco-bot project is to prepare an interactive ICT solution – knowing if the potential end-users will use such tool is of utmost importance. Question no. 17 aims at gauging the attitudes of the respondents toward the use of modern technologies (as suggested in the D2.3 report).

Question no. 17. (Instruction: Please indicate the most appropriate answer)

What is your attitude to using modern technologies?

- a. I am an enthusiast, I always use them
- b. I like and use them in everyday life
- c. My attitude is indifferent I use them as far as I think it is useful
- d. I do not like but sometimes I am forced to use them
- e. I do not like and try not to use them

Evaluation of the end-users willingness to use modern solutions will require further indications about users' preferences regarding the frequency and form of the information obtained -- but this type of information is more eligible as an account setting that can be modified from the user interface and as such has not been included in the preparation of the survey.

This concludes the part of the questionnaire dedicated to the energy behaviour, energy saving measures and segmentation of the end-users. The final part of the survey is dedicated to the data concerning characteristics of the respondents' households.

Questions relevant for characteristics of end-users

This part of the questionnaire starts with the further reassurance of the respondents that this survey is anonymous and that provided data are needed only for verification that a wide variety of individuals and social groups have participated in the research (in order to validate the findings that will be later used for the eco-bot modelling purpose).

Questions in this part of survey fall under three distinct categories, questions about: 1) demographic characteristics of the respondent's household, 2) net income of the household according to the respondent's country of origin and 3) the professional and educational qualification of the respondent. Three questions (no. 1, 2 and 3) about number, age, employment and health condition of the respondent's household inhabitants cover the first category.

Question no. 1 (Instruction: Please indicate correct numbers for each option)

Number of people in the house:

- a. Age 0-18 [slider]
- b. Age 18-65 [slider]
- c. Age 65+ [slider]

Question no. 2 (Instruction: Please indicate correct numbers for each option)

How many people in the house work:

- a. Set hours e.g. 9-17 [slider]
- b. Different shifts [slider]
- c. From home [slider]

Question no. 3 (Instruction: Please chose appropriate option and indicate correct number if needed)

Is there a bedridden or disabled person within your household?

- a. Yes [slider]
- b. No

All those characteristics may influence the overall energy consumption of a given household and at the same time limit the opportunities of implementing some of the possible energy saving measures. Question no. 4, concerning the household income varies accordingly to the household's country of origin as it was proposed in D2.3 report.

Question no. 4 ver. A: Spain (Instruction: Please select only one answer)

In which range can your household net income be found?

- a. 2500 EUR/month and more
- b. Between 1000 EUR and 2500 EUR per month
- c. 1000 EUR/month and less
- d. I refuse to answer

Question no. 4 ver. B: Germany (Instruction: Please select only one answer)

In which range can your household net income be found?

- a. 3600 EUR/month and more
- b. Between 2600 EUR and 3600EUR per month
- c. 2600 EUR/month and less
- d. I refuse to answer

Taking into consideration that questions about income are always tricky and considered by some a private matter an option allowing to refuse answering this question was included. The last part of the questionnaire (questions no. 5, 6 and 7) is dedicated to obtaining information about educational and professional qualification of the respondent (even though relation between those characteristics and energy use are not certain – as indicated in the D2.3 report) as it allows for verification of the inclusion of different social groups into the research and thus validating the obtained outcomes.

Question no. 5 (Instruction: Please select only one answer)

What is your highest education qualification?

- a. No education
- b. Primary education
- c. Secondary education
- d. Post-secondary/tertiary education
- e. Bachelor or equivalent
- f. Master or equivalent
- g. Doctoral or equivalent
- h. Other

Question no. 6 (Instruction: Please select only one answer)

What is your current employment status?

- a. Full-time employment [Please go to the question no. 7]
- b. Part-time employment [Please go to the question no. 7]
- c. Unemployed
- d. Self-employed

- e. Homemaker
- f. Student
- g. Retired

Question no. 7 (Instruction: Please select only one answer)

Which type of job do you have now?

- a. Professional and technical (for example: doctor, teacher, engineer, artist, accountant)
- b. Higher administrator (for example: banker, executive in big business, high government official, union official)
- c. Clerical (for example: secretary, clerk, office manager, civil servant, bookkeeper)
- d. Sales (for example, sales manager, shop owner, shop assistant, insurance agent, buyer)
- e. Service (for example: restaurant owner, police officer, waiter, barber, caretaker)
- f. Skilled worker (for example: foreman, motor mechanic, printer, tool and die maker, electrician)
- g. Semi-skilled worker (for example: bus driver, tannery worker, carpenter, sheet metal worker, baker)
- h. Unskilled worker (for example: labourer, porter)
- i. Farm (for example: farmer, farm labourer, tractor driver)
- j. Other

The last question (no. 7) is ancillary and only employed respondents (according to their answer to question no. 6) will be asked to answer it.

Summarising, each respondent will be asked to answer 22 questions (taking into account the dynamic nature of the question about past behaviours aimed at undertaken attempts to save energy in particular household) and respondents who are professionally active/employed at the time of taking part in the survey to answer 23 questions. Such a number of questions allows to obtain the information required to carry out the intended segmentation of the end-users, while maintaining a postulate about a not being overtly time-consuming for respondents.

The full questionnaire for individual consumers can be seen in ANNEX B.

4.4.3 Commercial users survey form: questions and expected results

Using the suggestions provided by the partners, by a desk study of issues concerning energy efficiency in the commercial building sector and good practices in the field of questionnaire design, questions have been developed that aim to obtain information allowing segmentation of the commercial sector end-users for the needs of eco-bot in

accordance with the report D2.3. MARKET SEGMENTATION MAPPING CONSUMERS' NEEDS TO THE TAXONOMY MODEL.

At first, the same as in the case of survey aimed at households, respondents will be informed about the purpose of the research, the potential benefits and why their contribution of the information on energy behaviours is important. Ensuring anonymity and voluntariness, as well as the possibility of verification of the institution conducting the research will be included in the welcome screen.

As for the overall planned order of questions, the questionnaire addressed to the commercial sector respondents can be divided into two thematically separate parts (as in the case of households survey), which will be described further along with the presentation of the particular questions and their intended purpose. The parts can be divided as follows: first questions concerning characteristics of the respondents (including those relevant for segmentation), secondly thematic questions about various aspects of energy efficiency and energy saving practices available for the organization energy users (including those relevant for segmentation) and the questions concerning preferred format and frequency of obtaining information from the hypothetical tool (in this case eco-bot).

Questions about characteristics of the commercial end-users

Taking into account the different climate and legal conditions established and limited to the commercial building sector target group of respondents (and later potential users) from three partner countries (Germany, Spain, United Kingdom), the respondent is first asked to indicate their country of origin (question no. 1). If the survey in this form will be used later on for the respondents from other countries this question will need to be modified so that it ultimately covers all countries under consideration (e.g. including other or all of member states of the European Union).

Question no. 1. (Instruction: Please select appropriate answers)

- In which country do you handle your buildings?
- a. Spain
 - b. Germany
 - c. United Kingdom

The **scale of activity** for which the respondent is responsible is an important factor from the point of view of the segmentation process. The expectations and information needs of the person responsible for the energy management or/and control in one building will be significantly different from the information needs of the person supervising several, dozens or hundreds buildings. Distinction by scale was one of the factors recommended for the segmentation of the commercial end-users in the D2.3 report. The last answer in the question no. 2 was included in case that a person not directly involved in handling buildings (e.g. a supervisor or manager) may be interested in obtaining information provided by the eco-bot.

Question no. 2. (Instruction: Please select only one answer)

How many buildings do you handle?

- a. Just one
- b. 2-10
- c. 11-50
- d. 51-99
- e. over 100
- f. I do not handle the buildings, but I am still interested

In addition to the business's scale, the nature of the business entity is also an important factor. An organization acting as energy provider or distributor will have different information needs and different goals concerning energy efficiency from the organization acting as an ESCO that tries to optimize some other organizations energy consumption and behaviour. Thus the questions no. 3 aims at categorising respondents accordingly to the type of organization they represent.

Question no. 3. (Instruction: Please select only one answer)

What kind of company are you working for?

- a. ESCO (Energy Services Company)
- b. Utility (Energy Producer/Distributor)
- c. OEM/ Hardware vendor
- d. Not an Energy-Related Company

An auxiliary question no. 4 regarding the characteristics of the entity represented by the respondent asks about the number of employees in a given company. There is no arguing that information needs will be different depending on the size of the organization represented by the respondent, but it should be also noted that this question is more aimed at verification if the group of the organizations represented in the research was broad enough to validate the obtained results and thus the intended segmentation of the commercial sector buildings end-users for the purposes of the eco-bot modelling.

Question no. 4. (Instruction: Please select only one answer)

How many employees work in your company?

- a. Just 1/ Freelancer
- b. 2-10
- c. 11-50
- d. 51-200
- e. 200-1.000
- f. 1.000-5.000
- g. 5.000-10.000
- h. over 10.000

Question no. 5 is concerning the exact **type of commercial buildings** handled by the respondent and has two purposes. Firstly it is also intended as the verification of the

research coverage for different types of commercial buildings and their purposes (the commercial building sector is extremely diverse concerning the types of activities, i.e. even similar types of use may have different energy needs and information needs – retail store specializing in the frozen foods will have different energy needs from typical grocery retail store or cloths retail store). And secondly depending on the provided answers it may be later on used for providing more detailed and personalized advice for the end-user (e.g. if the respondents handle only office buildings he or she will have different information needs from someone handling only hotels or restaurants).

Question no. 5. (Instruction: Please select only one answer)

Which type of buildings do you handle?

- a. Education facility
- b. Factory
- c. Health centre
- d. Hospital
- e. Hotel
- f. Housing
- g. Industrial warehouse
- h. Leisure facility
- i. Library
- j. Museum
- k. Office building
- l. Parking
- m. Restaurant
- n. Retail store
- o. Small office
- p. Sports facility
- q. Supermarket
- r. University

Questions relevant for segmentation of end-users

The form includes questions related to the behaviours occurring in the organization represented by the respondent (delineated in the form of declarative questions concerning **willingness to change behaviour or invest**, as suggested in D2.3 report for the purpose of the segmentation) as well as solutions for saving energy present in the buildings she or he handles. Question no. 9 evaluate the scope and willingness of the represented by the respondent organizations to invest in energy saving solutions. The list of solutions is more exemplary than comprehensive in nature and is intended more as a measurement of the willingness to change than a declaration for taking on any of the presented possible solutions.

Question no. 9. (Instruction: Please select only one answer)

Which of the following energy saving measures could your organization easily afford an investment in?

- a. Replacement of equipment's for more efficient ones (Light bulbs with LED bulbs, new boilers, heat recovery etc)
- b. Apply Free Cooling
- c. Stop stand-by consumptions and turn off lights when not in use
- d. Focus consumption on off-peak hour
- e. Retrofit the building envelope
- f. All of the above
- g. None of the above

In addition to providing data for the segmentation process results may be later on used in preparation of more personalised advices for the end-users. Knowledge about existing financial constraints in given organisations would be better for the segmentation purposes but the respondent may either a) not know about such limitations or b) not be willing to provide such information. Considering that, it was decided against asking more direct question about financial or investments possibilities in organization represented by the respondent. Another aspect important from the point of view of intended segmentation is the time **frame for adapting** energy saving solutions in the organization represented by the respondent (question no. 11).

Question no. 11. (Instruction: Please select only one answer)

How long does it take to adopt a scope energy saving measure in one of the buildings that you handle?

- a. Less than one week
- b. Between one and four weeks
- c. Between one month and 5 months
- d. More than 6 months
- e. Don't know

Both in the question no. 11 and no. 12 the option "Don't know" was included as a way for respondent to refuse to answer if he or she is not willing (e.g. as such information may be perceived as a strategic information from the competitive point of view) or if she or he is not aware of how long such process usually takes. Questions no. 12 concerns the expected time of return on energy efficient investments in the respondent's organization. Provided information may be used for segmentation of the respondents and on the same time for personalization of the advices provided by the eco-bot (especially when combined with data gathered by the questions no. 9 – about the potential scale of investments).

Question no. 12. (Instruction: Please select only one answer)

What is the expected time of return on energy efficiency investments in your organization?

- a. Less than six months
- b. Between six and twelve months
- c. Between one year and five years
- d. Between five years and ten years

- e. More than ten years
- f. Time of return is not important
- g. Don't know

Question no. 15 concerns the preferred frequency of obtaining information provided by eco-bot. It was debated if this question should not be included in the users account settings in the application panel, but it was decided it may provide data that will be relevant as an auxiliary question for the segmentation process, and as such included in the survey. The underlying assumption was that preferred frequency of receiving information will differ between managers/handlers at different organisational levels or depending on a particular situation.

Question no. 15. (Instruction: Please select only one answer)

How often do you want to receive information about energy efficiency in the buildings you handle?

- a. Daily
- b. Once a week
- c. Once a month
- d. Less than once a month
- e. Requested while needed

Several further questions aimed at obtaining information about **past behaviours** and possible solutions already adapted by the respondent's organization were included in the form. They are rather general in nature, asking about a type of action rather than particular implemented solutions. All those questions could be later on used for preparing more personalized advices for the particular respondents, and as an indirect benefit give respondents an idea about energy saving measures that they can pursue on their own. However, after consulting with Dexma and to avoid constructing a form that is too long, questions marked by the X and number (X1; X2; X5 and X6) in the text were removed from the final survey questionnaire. Questions X3 and X4 were developed in tabular form and were included in question No. 7.

Question no. X1(Instruction: Please select only one answer)

Are systematic internal solutions for managing energy efficiency (e.g. specific instructions or policies, regulations concerning temperature comfort) implemented in buildings you handle?

- a. Yes
- b. No

Question no. X2(Instruction: Please select only one answer)

Are external solutions for managing energy efficiency (e.g. ISO norms, Green Labelling) implemented in buildings you handle?

- a. Yes
- b. No

Question no. X3(Instruction: Please select only one answer)

Are systems for monitoring energy behaviours of employees implemented/used in the buildings you handle?

- a. Yes
- b. No

Question no. X4 (Instruction: Please select only one answer)

Have you ever considered applying for a subsidy through a support programme of your commune or the federal government?

- a. Yes
- b. No
- c. I don't know of any support programmes

Question no. X5 aimed at providing information for the team that will later have to prepare the scenarios and advices given to the end-users by eco-bot. As such it also could be included in the users settings but obtaining it at this stage of the project was considered to be beneficial for further modelling processes and preparation of the user experience and frontend part of the application.

Question no. X5(Instruction: Please select only one answer)

What type of information about energy efficiency in the buildings you handle you want to receive?

- a. Simple summary
- b. Very detailed graphical information
- c. Very detailed tabular information
- d. Very detailed tabular and graphical information
- e. Requested according to particular needs

At this stage the survey form was rather short and did not required a lot of time for the responded to fill, at the same time it was sufficiently complex to provide data needed for the segmentation of the commercial buildings sector end-users (which according to the D2.3 report is less complex than the households end-users segmentation and consist only of three designated segments). Nonetheless after consulting with other project partners more questions were included into the final form of the questionnaire.

Additional questions relevant for segmentation of end-users

The partners suggested that more questions concerning the behavioural aspects should be included in the survey. As the organization performance in all aspects (including energy efficient behaviours) depends on how the people (managers, employees and potential customers) will behave when residing in given building. In order to supplement the gap considering the behavioural aspects, appropriate questions (from no. 5 till no. 7) from the household end-user questionnaire were adopted for this purpose.

Question no. 6. (Instruction: Please select only one answer)

Were there any attempts to optimize energy consumption in buildings you

handle?

- c. Yes [Please go to the question no. 7]
- d. No [Please go to the question no. 8]

The mutually exclusive character of question no. 6 directed at **past behaviours** or **motivations** of inaction was preserved - that is, for all respondents the questionnaire form extended only by two questions in total.

Question no. 7. (Instruction: Please select appropriate answer for listed actions, accordingly: 8-Always, 7-Very often, 6-Often, 5-Occasionally, 4-Rarely, 3-Very rarely, 2-Never, 1-I do not know)								
How often and what kind of attempts to optimize electricity consumption in buildings you handle were undertaken in the past ?	8	7	6	5	4	3	2	1
Turn off lights and appliances when not in use								
Buy green energy from my utility provider								
Use energy-efficient bulbs								
Use energy-efficient office devices								
Change settings on the thermostat (turning up air-conditioner in the summer and turning down thermostat in winter)								
Consume less								
Do not leave devices on stand-by								
Changing the heating / cooling system to a more efficient one								
Close windows before turning on or up the heating								
Implement systems for monitoring energy behaviours of employees								
Apply for a subsidy for the implementation of energy optimization solutions								
Question no. 8. (Instruction: Please indicate the three most important reasons)								
What were the reasons for not attempting to optimize electricity consumption? <ul style="list-style-type: none"> a. Lack of time b. Cost/Money c. Scepticism (will it make a difference?) d. Lack of information e. Conflicting information f. Lack of adequate knowledge g. Other more pressing priorities h. Lack of practical or technical support i. Change of circumstance j. Change of priorities k. The belief that this will require considerable effort 								

Also the question no. 10 aimed at the change-capacity, openness to changing habits in the respondent's organization was included in addition to questions considering financial or time constriction (once again it was adopted from the household end-users survey).

Question no. 10 (Instruction: Please select only one answer)

Would you be interested in adopting energy saving measures if they would require change of the behaviours in your organizations?

- a. Yes, I would definitely do so to protect the environment
- b. Yes, but only if it would reduce my bills
- c. Yes, but only if it will improve the value of my buildings
- d. Yes, but only if they are easy to implement
- e. No, I am not interested in any changes

Another aspect that according to the partners was lacking concerned the capacity and willingness to use modern technologies as a means for ensuring more energy efficient solutions in respondent's organization. Taking into consideration that the aim of the eco-bot project is to develop a modern, technological advanced advisory tool in a form of a chat validates the importance of such inquiries. In order to assess the declarative willingness to use modern technologies in general and chat bot type tools in particular three appropriate questions were added to the survey (no. 13, 14 and X6). It should be also noted that this questions aimed at assessing the respondent's and not the respondent's organization willingness to employ modern technology solutions.

Question no. 13 (Instruction: Please select only one answer)

What is your attitude to using modern technologies? (Please indicate the most appropriate answer):

- a. I am an enthusiast, I always use them
- b. I like and use them in everyday life
- c. My attitude is indifferent I use them as far as I think it is useful
- d. I do not like but sometimes I am forced to use them
- e. I do not like and try not to use them

Question no. 14 (Instruction: Please select only one answer)

Would you like to use a chat bot tool to help manage energy in buildings you handle?

- a. Yes
- b. No

Question no. X6(Instruction: Please indicate 3 most appropriate answers)

What are your expectations concerning information received from eco-bot?

- a. I expect reports about past energy usage of my buildings
- b. I expect to get information about energy use according to main metrics of building
- c. I expect to save energy due to automatic tasks set by eco-bot
- d. I expect to receive the energy use forecast for my buildings
- e. I expect information about my handling of my portfolio of buildings
- f. I expect to be kept up to date about new EE regulations
- g. I expect to get recommendations about possible retrofits
- h. I expect to be informed if there is a hardware malfunction
- i. I expect to get information about contract with my energy providers
- j. I expect to receive information about disaggregated loads for appliances
- k. I expect to receive information from sensory data in order to react to it
- l. I expect to receive the charts allowing for trend tracking

Summarising, each respondent will be asked to answer 15 questions (taking into account the dynamic nature of the question about past behaviours aimed at undertaken attempts to save energy by particular organisation). Such a number of questions allows to obtain the information required to carry out the intended segmentation of the end-users (at the same time providing additional information about approach, expectations and willingness to use modern technology solutions for energy saving), while maintaining a postulate about a not being overly time-consuming for respondents.

The full questionnaire for commercial users can be seen in ANNEX C.

5. Report on the results of the first online surveys

5.1 Characteristic of the survey and selection of the sample

The study was conducted using a standardized CAWI method exploiting a questionnaire form for individual and commercial users, described in section 4 in this report.

Currently, the CAWI method is one of the most popular and the fastest growing methods of consumer research. Compared to other methods, thanks to the sense of anonymity and the possibility to participate in the study at a time convenient for the respondent, it allows to gather more reliable data (Groves et al. 2009). The CAWI method has been used in this study due to the fact that research using traditional methods, such as personal interviews, conducted by interviewers or over the phone, are becoming less and less popular. First and foremost, it is becoming increasingly difficult to reach potential customers personally, among others due to the protection of personal data, absences in homes or reluctance to contact the researcher directly.

The research sample was selected in a targeted manner, in accordance with the assumptions of the non-random selection of the respondents' sample. Moreover the purposive sampling method was chosen.

Field research was conducted among the clients of the consortium partners in the countries that will participate in the pilot phase of eco-bot application.

Survey research concerned two basic groups of respondents: individual and commercial. In the spatial dimension, surveys were carried out among respondents in the following groups:

- **countries with moderate level of political and institutional support for the implementation of the eco-bot application:** - Germany,
- **countries with medium level of political and institutional support for the implementation of the eco-bot application** - Great Britain,
- **countries with a high level of political and institutional support for the implementation of the eco-bot application** – Spain.

This division is in line with the findings in report D2.2 (see pages 11-28 of D2.2). As the most important criteria from the point of view of the implementation possibilities of eco-bot solutions have been considered instruments aimed at improving energy efficiency and behavioural changes.

The survey was sent to all Dexma Sensors SL, Estabanell Y Pahisa Eneregia SA and Senercon's GMBH customers and in the preparation phase of the questionnaire, representatives of Estabanell partners in person of Ms. Farah Cheaib; of Dexma with Ms. Laura Martinez and Senercon in the person of Ms. Claudia Julius were participating in the modification of questions and in the translation of the questionnaire into national languages.

The survey was conducted from June to September 2018 and the questionnaire was placed on the platform for creating surveys - ankieteo.pl. In order to obtain data to create a classification model, the KAT team (with the partners help) prepared three language versions of the survey for individual consumers:

- Catalan version - which interested 159 people who opened the survey portal, but only 64 of them started to fill the survey in
- the Spanish version - which was not finally sent to the respondents
- German version - where 48 people opened a questionnaire, but only 29 people started to fill it in.

In addition, of the 93 people who started answering the questionnaire, only 81 people completed the survey, of which only 37 questionnaires were filled in completely - the respondents answered all the questions.

KAT team also prepared a survey for commercial consumers in the Spanish and English language versions - but during the survey only 4 returns were obtained which is insufficient material for building the model. Therefore, the detailed results of these versions of the questionnaire will not be presented in the report.

A brief description of how the respondents proceed during the study:

- Catalan consumers became interested in the survey between July 9 and August 22
- German consumers were interested in the survey between August 15 and September 30
- **The average time of completing the questionnaire was: 20 minutes**
- Half of the respondents completed the survey within no more than 17 minutes
- For some people, the duration of the survey was very long (several hours), but we assume that these were people who started answering questions, then they stopped and only after a few hours they finished filling out the questionnaire - they were considered as outliers

- **Respondents who did not complete the survey usually looked at it for no more than a minute**
- **Large gaps in respondents' replies were recorded**

Taking into account the results of the research, the following conclusions were made:

1. The collected material is not sufficient to build a stable consumer classification model
2. With weak data (too many incomplete returns and too few returns altogether), the model will show an error rate of almost 50% - (the error rate can be compared with the results of the theory of probability - 1 out of 2 respondents will receive wrong recommendations in the future)
3. Despite the above, initial questions (variables) relevant to building the consumer classification model have been identified - which are presented in the following section of the report (5.3)
4. On this basis, it was decided to repeat the survey.

5.2 Obtained results of research on segmented questions for individual energy consumers

The survey prepared for the needs of the eco-bot project consists of two types of questions. The first group are the segmenting questions. This part of the report will present the distribution of respondents regarding this group of questions.

Segmentation questions were constructed on the basis of the market segmentation of private households adopted by adelphi, based on in-depth literature studies (Frankel et al. (2013; see D2.3 p. 11 and further). The proposed segmentation is aimed at identifying in a first step the attitudes, motivation and willingness to change towards sustainable energy consumption, of potential customers of the eco-bot application. D 2.3 proposed to segment along the lines of motivation and ability to enact change. The latter resulting into the subsegments and the first resulting in the following five main segments:

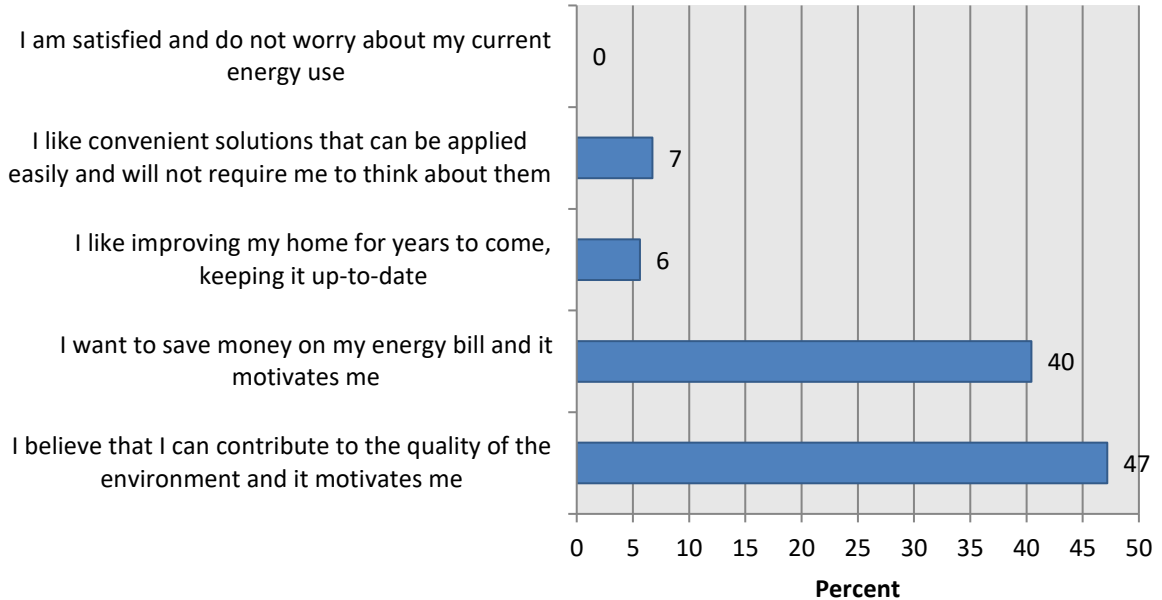
- **Green-advocate energy savers** - report the most extensive energy-saving behaviour. They are motivated by their strong pro-environmental attitudes and values. Their interest in new technologies to achieve their energy saving goals is notably high.

- **Traditionalist cost-focused energy savers** - report to save significant amounts of energy, driven by the interest of saving cost. Their interest in new technologies is limited, as it is not an interest per se in the technology but again, an interest in potential cost savings.
- **Home-focused selective energy savers.** are motivated by the possible home-improvements and show a high interest in new technologies that allow such improvement. Reducing cost is another motivational factor. The cost saving interest has to be understood as a long-term one, in other words, people in this segment are willing to invest in the home to ensure better energy bills in the future.
- **Non-green selective energy savers.** are more convenience oriented. Even though they are not concerned about the environment, they are willing to save energy as long as it is easy, and they do not have to think about it. New technologies that allow “set and forget” interventions are therefore welcome.
- **Disengaged energy wasters.** do not intend to save energy and are neither concerned with the environment nor with financial aspects regarding energy usage. Accordingly, there is also no interest in new technologies to support or enable energy savings.

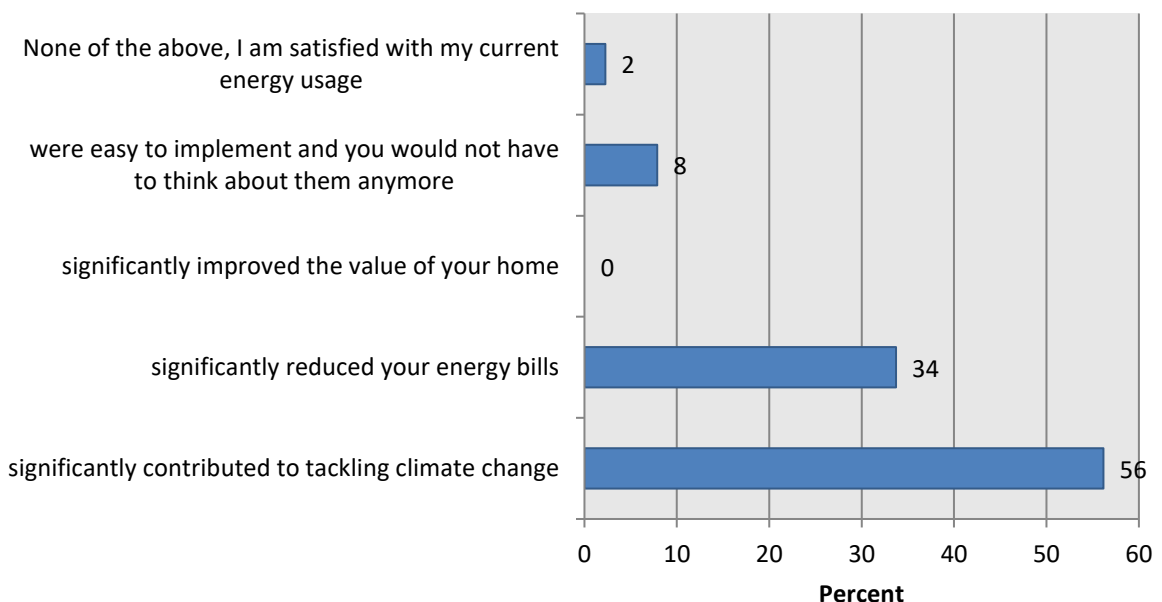
The aim of this part of the survey is to collect results of division of respondents in order to create a training set for the model - so that the model can learn appropriate allocation of a new user to the corresponding segment in the assumed segmentation. Once this is achieved, the next step will be to connect the assigned consumer in the relevant segment to the features that will characterize him/her based on the responses to the remaining questions given in the study.

In the study, 4 segmenting questions were set up: question 8,12,13 and 14 from the form. The results obtained are presented below.

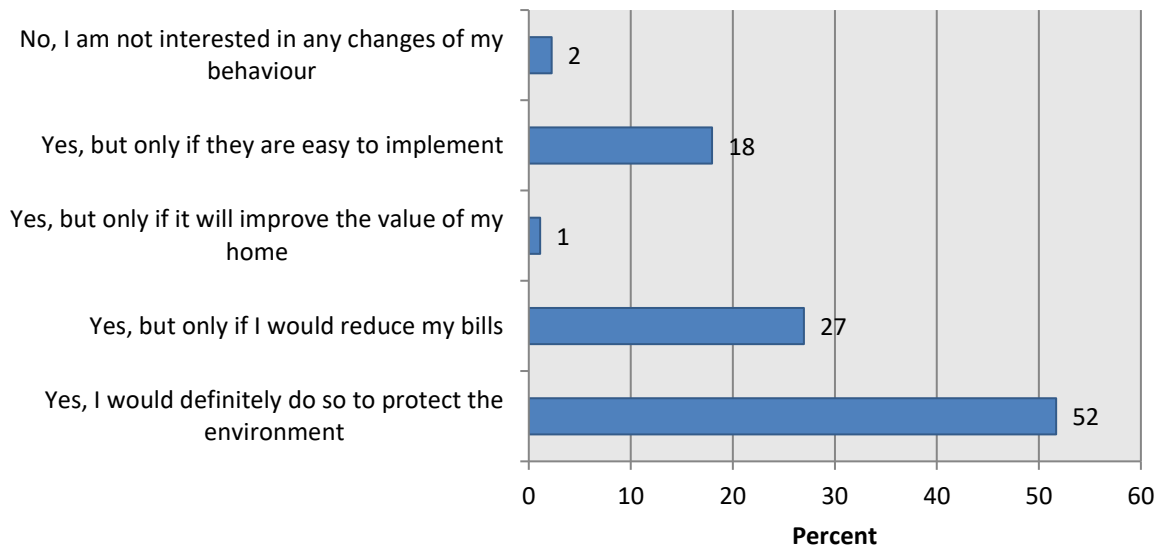
Q8. Which of the following statements regarding energy use you can most relate to?



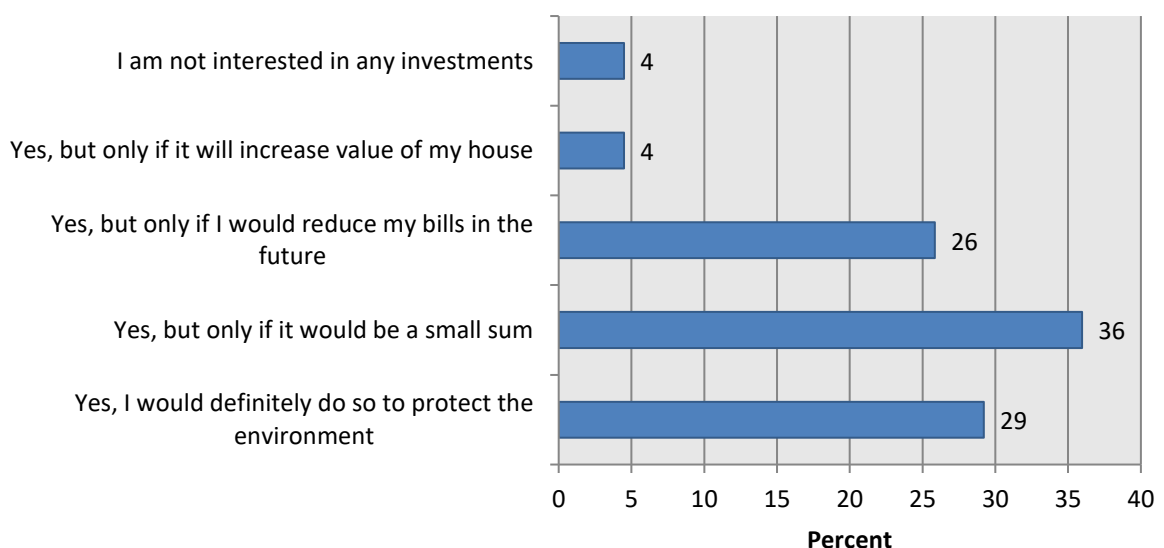
Q12. Would you be most likely to adapt energy saving measures if they:



Q13. Would you be interested in adopting energy saving measures if they would require change of the behaviours in your household?



Q14. Would you be interested in adopting energy saving measures if they require you to make investments?



As can be seen in the graphs presented, in each question the respondent has 5 possible options from which he should choose only one. We linked each answer to one of the types of consumers of the segmentation. The respondent chooses the answer that best suits his/hers attitude, motivations or beliefs and on this basis he/she is assigned to the appropriate segment. It should be noted that the authors placed segmenting questions in the study in different parts of the questionnaire so that the previous answers did not affected the current one. Moreover the suggested variants also appeared in different order for subsequent segmenting questions.

After analyzing the answers to individual segmenting questions, we received the following distribution of consumers between the assumed segments (see Figure 1):

- Green-advocate energy savers (GAES) – 49.4 %
- Traditionalist cost-focused energy savers (TCFES)- 37%
- Home-focused selective energy savers (HFSES) – 1.2 %
- Non-green selective energy savers (NGSES) – 9.9 %
- Disengaged energy wasters (DES) – 2.5 %

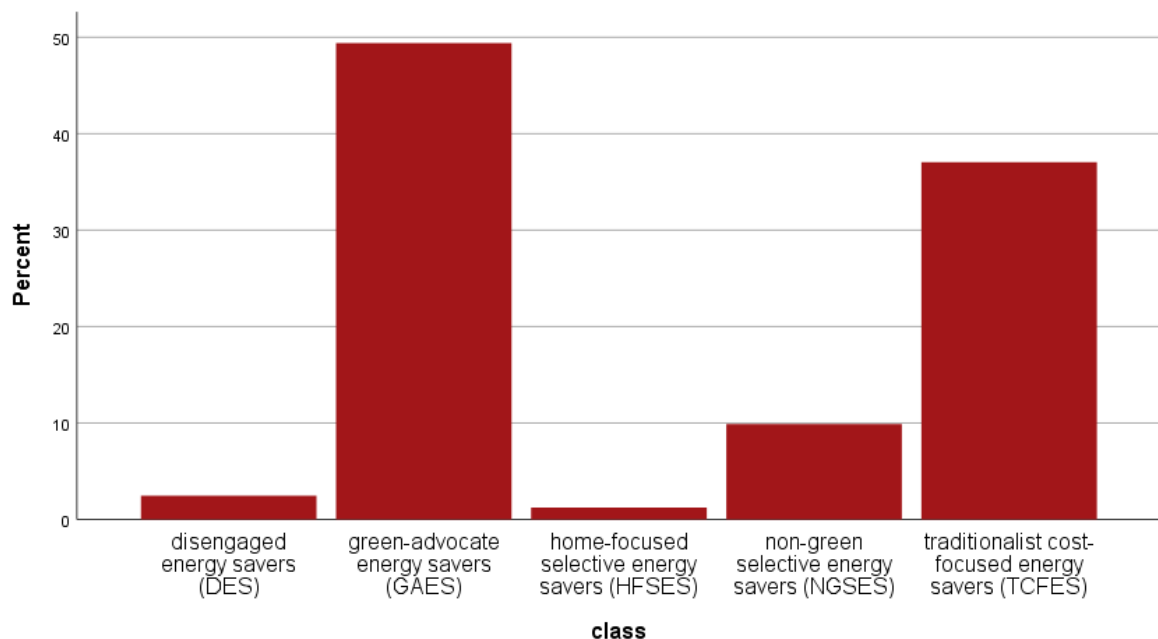


Figure 1. Distribution of consumers between the segments proposed by adelphi on the basis of the results of surveys

As can be seen from Figure 1, the respondents were mainly classified into two categories on the basis of responses: Green-advocate energy savers (GAES) and Traditionalist cost-focused energy savers (TCFES). It should also be mentioned that while analyzing the answers of respondents to segmenting questions, the model was not always able to determine the affiliation of a given consumer to a given class in an unambiguous manner. In some cases, the consumer's affiliation was equally close to the second (cost focused TCFES) and the fourth (non-green NGSES) type. According to the applied methodology, respondents may be assigned to both the non-green and cost focused classes, but taking into account the results of the remaining questions of the questionnaire as well as expert knowledge and experience of researchers, they have been assigned to the non-green sector.

To ensure correct operation of the model, the training set should contain all the options possibly existing in the examined reality. As the results of surveys of segmented questions show, the proposed segmentation does not fully reflect all foreseeable options of consumer beliefs and motivations. With the selected questions and method, the proposed segmentation could not be fully verified. It would be possible if construction of the questionnaire is a more complex, however it is not realistic, because with too many questions and complex responses, respondents are not eager to complete surveys, thus a pragmatic approach was chosen.

If there is no adjustment of the assumptions at the research stage (in this case, segmentation modification), the model is not able to learn the characteristics of "non-existent" segments during training (in this case, segments with fewer samples) and then in the use phase it will not be able to classify new respondents, according to their characteristics, to the correct classes. Model will not recognize properly the user's behaviour and they will be assigned to a wrong class, which will significantly increase the error of the model and will lead to provision of incorrect recommendations to such a person by the application.

In the case of this study, such a possibility is highly probable, hence, in agreement with adelphi, the initial segmentation was adapted on the basis of empirical findings.

The description of changes is presented in the further part of the report.

5.3 Presentation of the model-sensitive questions characterizing individual consumers obtained during the first examination

The second group of questions included in the questionnaire were questions that should contribute to the characteristics of the consumer in particular segmentation sectors. These are all the remaining questions (except for segmenting questions) in the questionnaire.

The authors of the study tried to include in the prepared questionnaire the broadest spectrum of behaviours, expectations and factors influencing the change in the behaviour of energy consumers. However, each survey has specific limitations, such as limiting the number of questions asked or their complexity, so that the respondents do not feel discouraged to complete the study. Hence the authors were not able to include all factors affecting behaviour in the study. Also, it was necessary to take into account that the study will be conducted in different countries with different specifics and the questionnaire should be prepared in such a way that it meets the objectives of the study in all conditions. Observing the results of the first research, the authors conclude that judging by the numerous deficiencies in completing the form, the prepared questionnaire was still too extensive.

The results of the first questionnaire cannot be taken into account to build the right model for the eco-bot project, thus only 10 questions indicated by the "trial" model will be presented here. These questions were to be used during the testing phase to the proper customer characterization and classification. 10 questions may seem a lot, but it should be remembered that the questionnaire was made up of 24 questions, most of which were expanded to several sub-items of the answer option. Each variation is treated as a separate question, hence the model analyzed in this case over 100 variables.

These questions were ranked according to the hierarchy of significance for the correct operation of the model: from the most significant to the least important and were referred for the purposes of comparison to the repeated survey described later in the report. The distribution of responses to individual questions in accordance with the priority hierarchy are presented in Annex D.

Shaping the pro-ecological behaviour of modern consumers is now a priority and an ambitious challenge. Influencing the behaviour and decisions of individuals to create a more conscious, committed and sustainable consumer is also the goal of the eco-bot project.

Environmentally responsible consumers limit consumption, including the amount of consumed goods, prefer durable and economical products, are ready to share products with other people, buy products that can be recycled, participate in explanatory trainings on how to use purchased products in an environmentally-friendly manner. All these

behaviours, however, result from the needs of the customer and their studying and identifying are not easy.

Some needs are hidden, confidential, which further limits the possibility of knowing them. Consumer needs can change over time and space under the influence of many different factors. Research shows (Chaudhuri, 2006; Evans et al., 2006; Hawkins et al; 2001); that consumer behaviour is to a much greater extent caused by emotional rather than rational factors. In addition, consumers are also focused on short-term goals. It is difficult for them to think about the future. Many consumers say that price is the basic selection criterion for them. However, consumer declarations can be significantly different from real behaviour. Consumers also make decisions easier when they have limited choice.

Analyzing a number of factors affecting consumers' behaviour and choices, the selection of key questions to be used to classify energy consumers does not seem surprising.

Questions with the highest rank refer to consumer habits, pro-ecological actions taken in the past. The most-important seems to be the declarations of not leaving devices in the stand-by mode. The next question examines the process of consumers making an informed choice - also regarding past activities, where hanging laundry to dry instead of using a tumble dryer seems to be on the one hand a choice of ecological action and on the other the resignation of time saving. High in the significance ranking is the question regarding the level of consumer education. The choice of this question may indicate that the level of knowledge, especially the consumer's ecologic awareness or lack thereof, is important for building the model.

The next questions concern the choices, beliefs and lifestyle, which also affects the behaviour. Lifestyle, especially when it comes to energy consumption is an important factor that can determine the nature of the consumer and its allocation to the relevant sector. A lifestyle has many dimensions in which one can observe a concrete level, that is, behaviour and actions. Based on them, you can conclude about others. The level that generally affects behaviour is represented by values and norms that determine human interests. They also shape his views and beliefs, which directly affects the individual's actions.

In our study, the model chose questions to identify consumer views on environmental issues (determine the level of consumer sensitivity), revise habits (replacement of bulbs, the way of washing clothes), obtain information on the level of knowledge about energy management at home (change of tariffs) and assess the level of willingness to change into ecological behaviour (reduction of consumption). It is worth mentioning here that the questions presented, selected by the model as the key to consumer classification, are related to the segmentation and research results obtained. As a consequence, they may change at the moment of obtaining full survey results or conducting a new research based on other assumptions.

6. A new approach to energy consumers' segmentation

6.1 Segmentation criteria, factors and trends in consumer behaviour used for the new approach

Analyzing the outcomes of the field study, as a result of receiving only two sectors of consumers: Green-advocate energy savers (GAES) - 49.4% and Traditionalist cost-focused energy savers (TCFES) - 37%, it was decided, after consultation with partners from adelphi, to modify of the eco-bot customer segmentation approach.

The authors of the study tried to foresee the possibility of response so that the respondents could identify their attitudes, beliefs, motivations and choices as fully as possible. The purpose of such structured segmenting questions was to achieve the most accurate allocation of consumers to specific sectors. At the moment, when the obtained answers allow to classify the respondents to several segmentation groups, this objective may be considered as achieved. Then the model will have a full spectrum of consumers behaviour on which it will be able to learn correct classification. In this way, the risk of erroneous classification of the application user will be minimized.

According to the classical assumptions of research methods (M. Wedel and W.A. Kamakura (1999), after: (Sagan, 2009, p. 21). our basic dimensions of the analysis are taken into account in the approaches to segmentation research. The first dimension results from the nature of segmentation criteria (personal criteria like consumer characteristics and object criteria like consumer reactions to the marketing offer of enterprises), the second relates to the measurement method (observable and hidden), the third dimension is related to the methods of segment identification based on criteria (a priori identification or post hoc), and the fourth - segmentation function (descriptive or predictive)

The authors of the study, wanting to ensure achievement of the assumed goal, used the personal criterion in segmentation, observable as well as hidden measurement methods, a priori and post hoc identification and descriptive function of segmentation.

The personal criteria taken into account in consumers characterisation were, inter alia: income, region of residence and climate, number of household members, level of education completed, employment status, age structure of household members, lifestyle, motivations and past pro-ecological behaviour or lack thereof.

The implementation of this project assumed a priori criteria for segmentation of consumers based on the characteristics of segments according to the segmentation proposed in D 2.3.

The research carried out consisted in classifying respondents on the basis of the segmental variables identified in advance.. **To improve customer segmentation, more attention was paid to psychographic criteria, such as lifestyle and motivations, as described in report D2.3. In addition, post hoc segments were identified after the criteria were extracted based on respondents' statements in the first study.**

The way of using segmentation criteria in explaining consumer behaviour is also very important. This study uses descriptive segmentation, where consumers are grouped on the basis of interrelated or homogeneous sets of variables of a given type.

In this type of approach, all variables are treated as interdependent, and in the segmentation process, methods of interdependence analysis such as cluster analysis and principal component analysis are used. Then, after obtaining the segments, they are profiled using appropriate independent variables. More on behavioural modelling was written in the report D3.2.

Considering the obtained research results, in order to modify the consumer segmentation proposed in the D2.3 report, the authors also paid attention to the approach to the consumer in the aspect of sustainable development. Due to the outcome of the study, which resulted in an incomplete findings of consumer segmentation, it is reasonable to extend the literature studies carried out in the D2.3 report in order to better illustrate the characteristics of the modified segments. Hence, the authors refer to the so-called "New" approach to the consumer. It presents the character and features of the "present" (calling it a new) consumer who (Baker, 2004; Slaby, 2006; Bartosik-Purgat, 2011):

- **is a very dynamic, demanding person, constantly creating new needs;**
- **has experience gained thanks to its activities and processes taking place outside;**
- wants to live, satisfying his own needs in various areas of life;
- wants to experience new ventures;
- **has very good skills in using modern media,**
- it is not extremely loyal to the products or brands being purchased;
- has extensive knowledge of the techniques and principles of marketing instruments;
- wants to have more free time;
- is aware of his rights as a consumer;

- **has a more rational attitude towards the diversity of market offers, more often tends to give up emotional purchases for the benefit of deliberate decisions resulting from a wide analysis of pros and cons of all possibilities;**
- **can manage its budget more and more effectively;**
- often becomes multicultural, that is, has needs similar to the needs of other societies;
- has a greater ability to move;
- first of all, "he is aware of his new authority".

Changing economic, political, social and cultural conditions have an extremely significant impact on consumers' lifestyles. The present environment is characterized by pluralism of styles and ideologies, as well as by stressing consumer's individualism through consumption, the importance of information and the diversity of consumer's orientation. All these factors as well as the requirements of the modern consumer were tried to be included in the segmentation modification. In addition, the authors attempted to include the profile of a sustainable consumer in the new segmentation approach, which has been numerously characterized in the literature on the subject.

Due to the fact that in the study conducted by the authors, the respondents were mainly assigned by the trial model to two basic segments - ecological and economical, the authors tried to find other equally important features that could diversify consumer attitudes. In order to fully illustrate the latest trends in consumer behaviour and take into account as many possibilities of reactions of future application users as possible, while modify segmentation, the authors also take into account international research achievements in terms of sustainable segmentation [see: (Finisterra & Raposo, 2010); (Diamantopoulos et. al, 2003)]. As research shows, most segmentation models in relation to sustainable consumer are more dominated by environmental issues than by attempting to understand the social and economic sensitivity of the general public to the problem of sustainable development. Very often, there are difficulties with clear identification of the relationship between segmentation variables and the relation to the environment or sustainable actions undertaken in case of eg education, income level, age or belonging to a particular social class. Therefore psychographic criteria of market segmentation play an important role in balanced segmentation. (Wilk, 2015).

The research agency Roper Starch Worldwide distinguished six types of sustainable consumers (Emery, 2012; after Wilk 2015). In their segmentation, at the extreme poles of balanced behaviour, they found: truly green (17%) and non-green (11%) attitudes. The former are the type of pro-environmental activists, strong supporters of environmental protection who do not perceive any barriers in acting in sustainable way and show

willingness to cooperate. The second extreme attitude consists of people oriented in environmental issues but at the same time cynical and suspicious. They may also show a hostile attitude towards pro-ecological initiatives. The remaining four segments characterize the majority of consumers participating in the survey and differ in motivation and the degree of involvement in solving ecological problems. Thus, there were distinguished consumers of "almost green" (21%), effortless ecologists (16%), dreamy green (13%) and rational green (21%). "Almost green" on the one hand declare a strong pro-ecological attitude, but on the other hand their behaviour is limited only to easy actions, because they think that the problems of sustainable development surpass them. Effortless ecologists show a moderate pro-ecological attitude and just like almost green they are interested only in easy-to-implement activities. Dreamy greens lack knowledge and resources, hence they show limited pro-ecological behaviours, but if an opportunity would be created for them, they can become more eco-friendly. Finally, rational greens show interest in protecting the environment below the average, compared to the entire population. They believe that enterprises and industry should take pro-ecological actions and emphasize barriers that prevent them from taking their own initiative.

In the segmentation proposed by authors for eco-bot users, the social aspects included in the segmentation model of Natural Marketing Institute in Pennsylvania described in The LOHAS Report: Consumers and Sustainability were also taken into consideration (see: NMI, 2008; Ottman, 2011 p. 23-28; Dahlstrom, 2011 p. 99; Makower, 2009 p. 45-49). This model divided consumers into the following five groups (Wilk, 2015 p. 188-189):

1 "LOHAS" - these are the most environmentally conscious, holistically oriented and active consumers. They are active both at home and in their communities, they choose organic products, they are advocates of environmental protection. They preserve in such behaviours as saving energy and water, multiple use of plastic reusable bags and lobbying the authorities for the introduction of laws protecting the environment. As influential people, they recommend eco-friendly brands to friends and family. Consumers from this segment are actively looking for information about products, they also analyze corporate activities in the field of social responsibility, boycotting such practices that they do not accept. Distrustful of paid media, they look for information primarily on the internet, using social media.

2. The next segment – Naturalites - want to lead a healthy lifestyle, but to act they are motivated primarily by empty slogans, such as eg antibacterial, natural or free from chemicals. Such consumers are concerned about the adverse effects of chemicals on food or cosmetics. They perceive themselves as involved in the issues of sustainable development. Naturalites want to know more and become more active in environmental protection; they are susceptible to education in this area, especially when it can affect their own health.

3. Drifters (the third segment) are guided mainly by fashion and boycott companies with dubious ecological reputation, but the information is derived primarily from the media, not from the results of their own searches. They are willing to take simple pro-ecological behaviours that they understand, such as recycling and energy saving, but they are much less prone to advanced behaviours.
4. The Conventionals segment is motivated to pro-ecological action for practical reasons (eg the purchase of a refrigerator with a higher energy class due to the possibility of reducing future energy expenditure). For the same reason they use recycling or try to use the used products in a different way.
5. The Unconcerneds segment includes the least ecologically responsible consumers

6.2 Segmentation characteristics for the project's purposes

While constructing the changed segmentation of eco-bot customers, the authors took into account that factors influencing consumer behaviour are characterized by a fairly high dynamics of changes. What is more, the change in external conditions often contributes to the change in internal stimuli, which play an extremely important role in the acquisition and consumption process. By modifying the segmentation and adapting it to the needs of the project, it was noticed that in many theories and concepts concerning consumer behaviour some regularities are detected such as (Bartosik-Purgat, 2011, p. 50):

- economic rationality is not always taken into account by consumers when making decisions related to the purchase of goods;
- but consumer behaviour is not accidental
- consumer behaviour is conditioned by, among others innate and acquired needs, conscious and unconscious processes as well as rational and emotional factors.

Analyzing different approaches to consumer segmentation, including sustainable consumers as well as analyzing factors influencing consumers' behaviour, especially energy consumers, the authors have developed an improved segmentation of eco-bot clients, also based on the first empirical studies. As shown in Figure 2 the starting point was the preliminary division into two dominant groups obtained after conducting the survey: Ecological (E) and Money Saver (S). As the research showed, the respondents' approach to the issue of sustainable development and especially energy saving differed between sectors primarily in ideological (E) and financial (S) motives. However, wanting to diversify

consumers within these two sectors, bearing in mind the dominant feature, but also taking into account other factors, the authors decided on a deeper division of sectors distinguishing further 4 subsectors: Ecological Idealist; Aspiring Ecologist; Dedicated Saver, Opportunist. This division was influenced by factors such as: the impact of social groups, lifestyle and following fashion, habits, experience and past behaviour. As can also be seen in Figure 3, clients assigned to particular sectors differ in the degree of ecological awareness and the intensity of financial motivation. Thus, the Ecological Idealist is characterized by the highest level of ecological awareness with relatively low financial motivation. At the other pole is a Dedicated Saver which can be very well motivated financially but for whom ecological awareness is secondary.

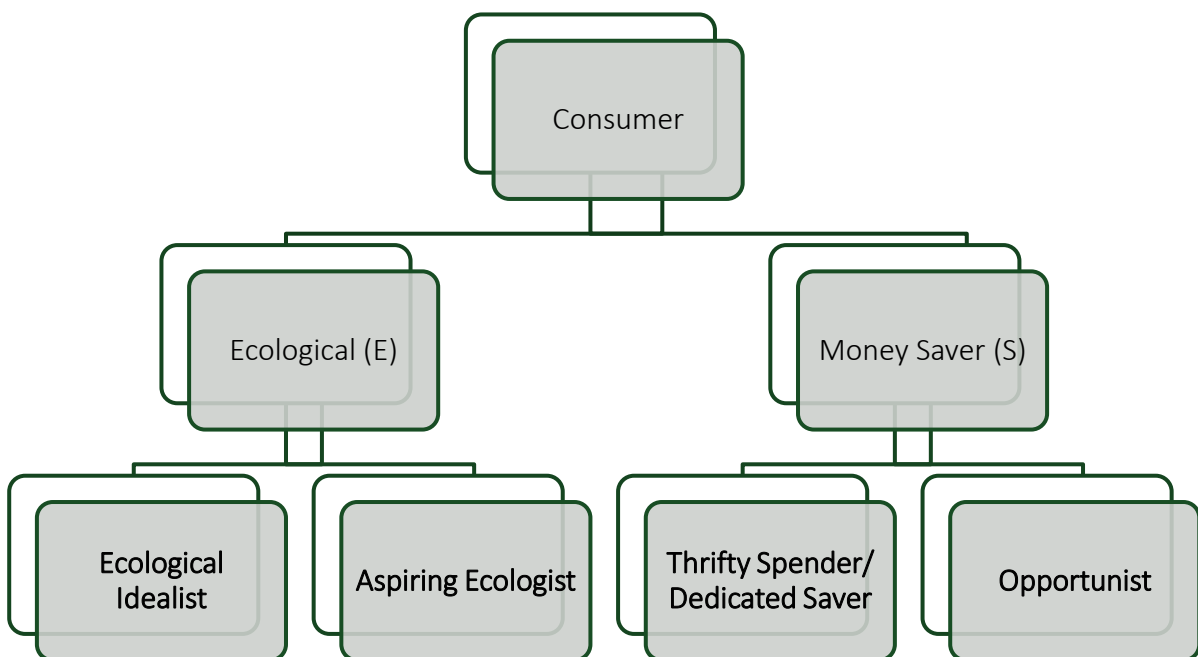


Figure 2. Division of eco-bot customers according to the new segmentation

During the survey, the authors also put in the questionnaire answers to the segmenting questions characterizing the respondents as the Indifferent type - it is a consumer who is not interested in environment, its protection and saving resources at all. Despite the fact that the respondents did not indicate such possibilities in their responses and nobody was assigned to this segment, the authors believe that it is also necessary to distinguish this type of consumer. As can be seen in Figure 3, it remains outside the scale of motivation characteristic of the remaining segments. As is clear from the specifics of this project - clients participating in the survey are interested in environmental issues at least in the

smallest degree or want to change their behaviour regarding energy consumption, but it cannot be ruled out that in the future, eco-bot applications may also be used by people who could be qualified for the Indifferent type. Therefore, recommendations will also be prepared for this sector, which at the initial stage of the project can be used to promote the project.

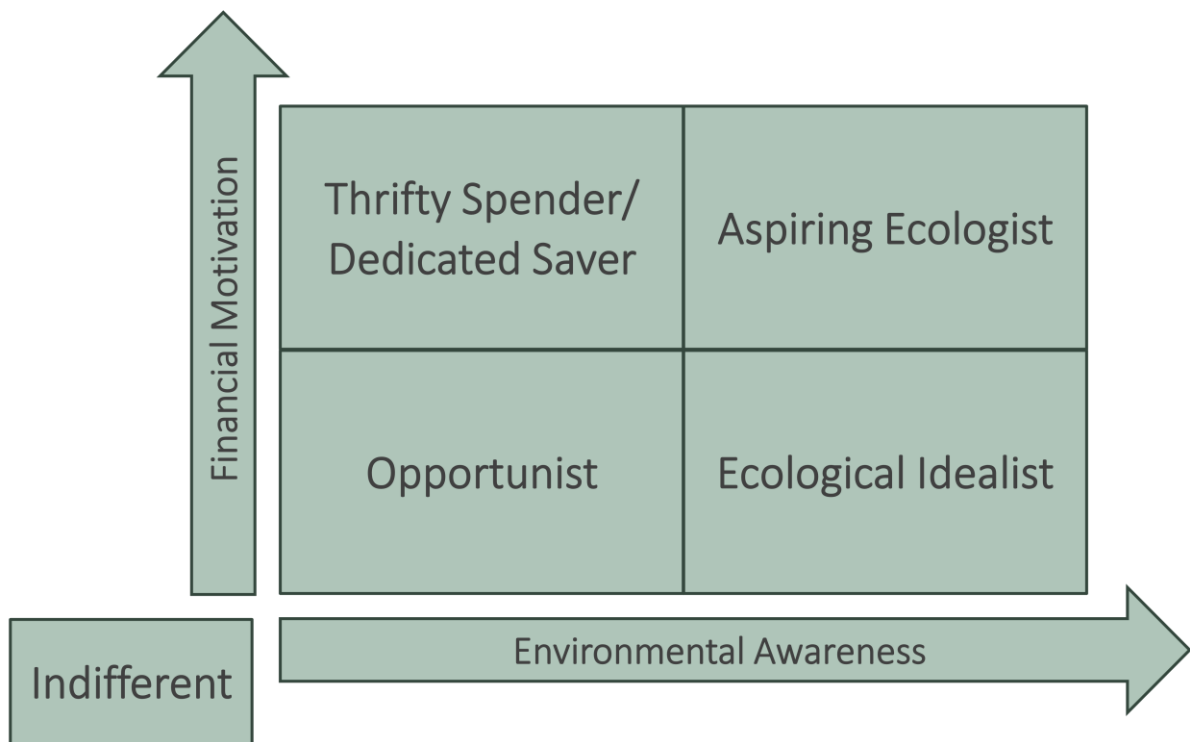


Figure 3. The scale of ecological awareness and financial motivation of eco-bot consumers

By creating the characteristics of individual segmentation groups, the authors of the report based on the results of the first empirical studies, which were enriched by the observations and results of the following authors: Frankel et al. (2013); Fuller D. (1999); DEFRA (2008); and others. The short description of all sectors is presented below.

- **Ecological Idealist - very high ecological awareness**

- they represent the consumers most involved in a wide range pro-ecological actions and behaviours and can be described as activists and leaders,
- their actions are influenced by thinking of environmental issues,
- they will recommend pro-ecological solutions to others and use given tips and guidelines,

- they will potentially be more financially involved in environmental issues, they are willing to cooperate with people and can even inspire others,
- often their involvement is manifested in the willingness to educate others and provide proven advices,

Aspiring Ecologist - high ecological awareness

- they are distinguished by the desire to pay a higher price for pro-ecological products, very often they compare themselves with other people,
- they are less motivated/inquisitive in their search, they are more likely to accept recommendation and advice from someone than they are looking for pro-ecological solutions,
- they are influenced by social groups in which they live, they follow fashion and they try to follow the directions - advice of others,
- very often they have a high socio-economic status, i.e. education, income and occupation, but are younger than the consumers in the above segment.

• Dedicated Saver - average ecological awareness

- they have knowledge about ecology, but environmental problems are not important to them
- they are not involved in solving ecological problems, although they can be ecological, provided that it pays off,
- they can be effectively motivated for ecological activities by financial factors - they are sensitive to the argumentation regarding cost savings, even in the long run,
- if it's profitable they can devote time and effort to save environment,
- over time, they may become representatives of one of the above segments.

• Opportunist - very low ecological awareness

- they belong to consumers who are relatively uninvolved in environmentally friendly behaviour but they can be ecological only if activities are easy to apply and comfortable,
- they save money but without exaggeration,

- if they behave in pro-ecological way, they generally operate very occasionally, irregularly and are also satisfied with their low involvement, they very often do not want changes,
 - however, they are also susceptible to influence.
- **Indifferent - lack of ecological awareness**
 - they show a complete lack of interest and care for their energy consumption and do not take the environment into consideration when they make a decision at home,
 - they are not motivated to act in a pro-ecological way, even through the possibility of financial benefits.

The Opportunist segment is the most difficult to reach with the message but at the same time the most promising group for the eco-bot project. However, the authors of the report developed eco-bot client engagement strategies for all segments, they were described in detail in the D3.2 report.

Re-conducted empirical survey will verify the assumptions regarding segmentation presented in this chapter, and its results will serve, on the one hand, to build the eco-bot behavioural model for energy consumers and, on the other hand, to create customer engagement strategies and to elaborate individual, tailored to the segment, recommendations.

7. Revision of the research tool - modification of the survey form according to new segmentation

7.1 Survey form for the individual household segment: questions and expected results

Due to the need to modify the segmentation proposed in the D2.3 and the resulting necessity to repeat the surveys, new questionnaire forms have been prepared for both individual households and commercial segments. As in the case of the previous questionnaire, involvement of the representatives of project partners (in person of Ms. Farah Cheaib of Estabanell; Claudia Julius and Maximilian Hengstenberg of SEnerCon GmbH and Laura Martinez of DEXMA sensors and Felix Huber of adelphi) for their help during the preparation phase in modifying the form and later in translating the questionnaire into national languages of intended respondents should be acknowledged. Both modified questionnaires will be described, first the one for the individual households sector and later the one for the commercial sector.

The questionnaire for individual households, as in the previous version, consists of two parts: the first one concerning energy-related behaviours and the second one concerning the household characteristics of a given respondent. At the beginning of the questionnaire (as in the previous version) the welcome screen will inform the respondent about the purpose of the research and ensure him or her about the anonymity of the survey. Then before proceeding to the proper questionnaire form, the respondent will be asked to agree to participate in the study (in the form of a question required an answer). In the absence of consent: by not choosing any option, the respondent will not be able to leave the welcome screen and asked again to indicate an answer, if the answer stating the lack of consent to participate in the study is marked, he or she will be redirected to the farewell screen thanking him or her for participation in the study. If the respondent agrees, he or she will then proceed to the first part of the questionnaire, which will be described next.

7.1.1. Questions relevant for segmentation of end-users

The first question (no. 1) has not changed compared to the previous questionnaire form and concerns the ownership of the flat / house in which the respondent currently lives. This question was proposed in the D2.3 report and remains unchanged as it is relevant for the segmentation purposes.

Question no. 1. (Instruction: Please select only one answer)

Do you own or rent the place you are currently living at?

- c. Own
- d. Rent

The justification remains unchanged and the question intends to find out if the user has **authority to buy and implement more costly solutions**. As a second question (no. 2), the new questionnaire form includes slightly changed version of question no. 6 from the previous version of the questionnaire. It is an extensive tabular question about previous behaviours related to energy conservation undertaken in the respondent's home. Both the indicated activities / behaviours related to the previous attempts undertaken to save energy were modified (marked in red in the question) as well as the available number of options indicating the frequency of taking indicated actions (changed from 8 to 6 options).

Question no. 2. (Instruction: Please select appropriate answer for listed actions, accordingly: 6-Always, 5-Often, 4-Occasionally, 3-Rarely, 2-Never/ Not applicable, 1-I do not know)

How often and what kind of attempts to optimize electricity consumption in your household was undertaken in the past?	6	5	4	3	2	1
Turn off lights and appliances when not in use						
Switch to green electricity in order to reduce CO2-emissions						
Use energy-efficient bulbs						
Reduce the heating temperature when leave the house in winter or increase the temperature on the air conditioner when leave the house in summer						
Reduce the use of home appliances						
Do not leave devices on stand-by						
Changing the heating / cooling system to a more efficient one						
Use home appliances mainly during off-peak hours						
Close windows before turning on or up the heating						

Boil the kettle with just the amount of water you need						
Prefer line drying than tumble drying						
Wash clothes at 30 degrees or lower						
Save warm water when taking a shower or bath or use the eco mode setting						
Purchase energy-efficient household appliances						

The decision to keep this question in the changed version was justified by the results obtained from the previous version of the questionnaire form, where several options from that question turned out to be important for the construction of the initial version of the model. The changes in the available options resulted from consultations with the partners and were intended to increase transparency and understandability for the respondent regardless of the final language version. The decision to transfer this question to the beginning was backed by three reasons: 1) in this version of the questionnaire form, a number of questions introducing the respondent to issues related to energy saving behaviours were abandoned, and instead this question should play such introductory role, 2) it was decided to put a similar verifying question, one that will examine the respondents declared willingness for changing their behaviours at the end of the questionnaire form, 3) due to the volume of the question and the related effort on the part of the respondent, it is more probable the respondent will give a reliable and thoughtful response at the beginning of filling out the form than later on. Justification of the question's legitimacy as a question assessing **the past behaviours** (part of the behavioural evaluation from the Triandis model) and potential indirect benefit of providing respondents with ideas of easy to undertake changes in their behaviours stays the same as in the previous form. Question no. 3 is a modified version of question no. 8 from the old form.

Question no. 3. (Instruction: Please select only one answer)

- Which of the following statements regarding energy use you can most relate to?
- f. I think about the environment, so I feel obliged to save energy
 - g. I want to save money on my energy bill and it motivates me
 - h. Green is new black and I want to help the planet
 - i. I like convenient solutions that can be easily applied
 - j. I am satisfied and do not worry about my current energy use

It is a segmentation question and the modification results from the change in segmentation and minor corrections in the formulation of some of the options - so that they are all similar to each other in terms of style and length of the sentence. This question further relates to

the **attitudes and motivations** of the respondent, but it still remains a declarative question and as such, the answers obtained with it should be verified by the remaining segmentation questions (questions no. 5 and no. 9). Question no. 4 is question no. 9 from the previous form with minor changes to facilitate the respondents ease of answering - options regarding the areas of respondents' actions have been changed (marked in red), and as in question no. 2, the number of options related to the frequency of actions has been reduced (from 7 to 5 options).

Question no. 4. (Instruction: Please select appropriate answer for listed activities, accordingly: 5-Always, 4-Often, 3-Occasionally, 2-Rarely, 1-Never/ Not applicable)					
For which of the following activities do you use your electric home appliances	5	4	3	2	1
Heating					
Cooking					
Cooling					
Air conditioning					
Laundry & Cleaning					
Entertainment					
Home office					
Gardening					

The logic behind formulating this question in such way has not changed: the question is still to be used both to measure current **behaviours and habits**, characterize respondents, and as a basis for the preparation of recommendations regarding potential ways to save energy. The selection of the most frequently undertaken actions will allow to prepare more tailored guidelines in terms of the needs of individual respondents - for example, if the most common source of energy consumption is air conditioning, it will be reasonable to prepare tips for good practices related to the use of air conditioning or alternative methods of cooling rooms, flats and houses. Question no. 5 is a new segmenting question prepared on the basis of modified segmentation and partly it uses options from question no. 15 from the old form.

Question no. 5. (Instruction: Please select only one answer)
Which of the following statements about energy saving applies to you:

- a. I save energy because my social group tells me how (or tells me to)
- b. I am well informed and feel motivated, thus I save
- c. I do not know how but I would like to save energy
- d. I save energy because I know it will reduce my bills
- e. I do not really thought about how to save energy

It is a question regarding the **current behaviour** of the respondent, formulated in a way that was intended to induce the respondent to reflect on the **motivation** of his / her actions (in accordance with the assumptions of the behavioural evaluation from the Triandis model). Question no. 6 did not change (in the old form the question was no. 13). This is a segmenting question consistent with the old segmentation assumptions proposed in the D2.3 report. Originally, the question, apart from the assignment to the relevant segment, was used to assess the tendency to change behaviour in the respondent's household.

Question no. 6. (Instruction: Please select only one answer)

Would you be interested in adopting energy saving measures if they would require change of the behaviours in your household?

- f. Yes, I would definitely do so to protect the environment
- g. Yes, but only if I would reduce my bills
- h. Yes, but only if it will improve the value of my home
- i. Yes, but only if they are easy to implement
- j. No, I am not interested in any changes of my behaviour

Currently, the character of this question has changed to the characterizing and auxiliary question, supporting the modified segmentation in the case of an ambiguous attribution of the respondent to one of the behavioural segments. Question no. 7 is a modified version of the question no. 7 from the old questionnaire form. In the old questionnaire form (which was dynamic in nature), it was a question that was answered only by respondents, who did not declare taking any actions in the past related to reducing energy consumption. The issue of not taking action as an important factor influencing the **motivation** of users to undertake such activities was considered too important for the question to be limited only to some of the respondents. This is the main reason for giving up the dynamic nature while preparing the current version of the questionnaire form. The question has been modified in terms of the formulation of the options and its number (it has been reduced) but the respondents are still able to choose more than one answer (but no more than three of the most important ones). Reasoning, as in the case of the previous version of this question, stays the same: there may be several different reasons for abandoning energy saving measures based on different conditions.

Question no. 7. (Instruction: Please indicate the three most important reasons)

What were the reasons for not attempting to optimize electricity consumption?

- p. Lack of time
- q. Too high cost/lack of money
- r. Lack of information/lack of knowledge
- s. Lack of practical or technical support
- t. Lack of opportunity for change
- u. Change of priorities
- v. It is too complicated to do it
- w. I did not think about saving energy

Question no. 8 is a new question aimed at measuring the influence, that a social group can have on a user (with whom he / she identifies or aspires) to take energy-saving actions. The issue of pressure of the social group in the previous version of the questionnaire was partially taken into account in question no. 15, where respondents were asked and indicate (on the 7-point scale) how much they agree or disagree with specific statements (regarding energy-saving behaviour, lifestyle, references to the behaviour of other people). That question was not used in the current version of the questionnaire form, but some of the statements referring to the **motivation** and **influence of the social** group were used while preparing the new questionnaire form.

Question no. 8. (Instruction: Please select only one answer)

Do you feel social pressure to save energy/be more energy efficient/reduce bills?

- a. I don't care about social pressure
- b. Yes, very strong social pressure
- c. Yes, but only moderate social pressure
- d. Yes, but only weak social pressure
- e. No, I do not feel any social pressure

The question in its current form aims to characterize users in terms of their susceptibility to influences and suggestions from the other people (either their own social group or one to which they aspire). In principle, the influence of the social group may become an important motivating factor for undertaking actions aiming at energy-saving behaviours, especially when the respondent identifies with the social group he belongs to or aspires to. In addition, the information obtained in this question may be useful for a more personalized formulation of advice and recommendations. Question no. 9 is a new segmenting question relating to the modified segmentation and aimed at measuring respondents' **attitudes**.

Question no. 9. (Instruction: Please select only one answer)

If I think about saving the energy, than:

- a. I want to use electricity from renewable sources

- b. I feel that energy savings suits my lifestyle
- c. I do not feel like I need to change anything
- d. I am concerned about rising energy bills
- e. I would like to use public aid

This is the last of the segmenting questions for the modified segmentation in the current questionnaire form and as such must allow confirmation of the respondent's allocation to the segment appropriate for him or her. In the previous version of the questionnaire form, it was noticed that a very large number of respondents indicated the importance of caring for the environment, which made segmentation difficult. This phenomenon was to some extent expected – it was expected that respondents more sensitive to environmental issues should be more willing to participate in the environmental research, in this case one concerning saving energy. Trying to avoid this issue in the current version of the questionnaire form, it was decided to formulate individual answer options in question no. 9 in such a way as to indicate the extreme behaviour attributed to each of the indicated segments. For example, instead of answering how much the respondent's actions are dictated by concern for the environment, we have a variant of the answer regarding the willingness to use renewable energy sources (the greenest possible action - segment Ecological Idealist) or identification with the respondent's lifestyle (segment Aspiring ecologist). Question no. 10 is a question that verifies the answers provided so far (especially from question 2) and examines respondents willingness to undertake various activities related to energy saving in the future. This question uses a list of measures to reduce the energy consumption in the household from the second question supplemented with investment activities (marked in red).

Question no. 10. (Instruction: Please select appropriate answer for listed actions, accordingly: 5-Already done, 4-Very possible in near future, 3-Not possible in near future, 2-I do not know, 1-never/not applicable)

How often and what kind of attempts to optimize electricity consumption in your household was undertaken in the past?	5	4	3	2	1
Turn off lights and appliances when not in use					
Switch to green electricity in order to reduce CO2-emissions					
Use energy-efficient bulbs					
Reduce the heating temperature when leave the house in winter or increase the temperature on the air conditioner when leave the house in summer					

Do not leave devices on stand-by					
Changing the heating / cooling system to a more efficient one					
Use home appliances mainly during off-peak hours					
Close windows before turning on or up the heating					
Boil the kettle with just the amount of water you need					
Prefer line drying than tumble drying					
Wash clothes at 30 degrees or lower					
Save warm water when taking a shower or bath					
Invest in renewable energy sources such as solar panels, geothermal energy or wind energy					
Use home insulation					
Purchase energy-efficient household appliances					

During the preparation of the current questionnaire form, the change of the wording regarding energy saving activities was considered so that the question no. 10 would not resemble the question no. 2 too much. Finally, a decision was made to leave it unchanged for two reasons: a) the questions are separated by a series of questions and in online form by 3 screens - the respondent may return to question no. 2 but the probability of doing so is small b) it is an extensive tabular question of a type that requires more effort from the respondents to fill in – and familiarity of the answers should lessen its difficulty considerably. The question is declarative, but it can be used to prepare more tailored recommendations, especially in terms of activities that are most often indicated as possible in the near future. The last question in the section on energy behaviours, question no. 11 is a modified question regarding the old version of segmentation (question no. 14 in the previous version of the questionnaire) and has been retained as a question characterizing respondents' tendencies for possibility of investment as a mean to reduce energy consumption.

Question no. 11 (Instruction: Please select only one answer)

Would you be interested in adopting energy saving measures if they require you to make investments?

- f. Yes, at any cost because money barely matters to me if it comes down to protect the environment
- g. Yes, but only if it would be a small sum

- h. Yes, but only if it pays off in a short time
- i. Yes, but only if it will increase value of my house
- j. I am not interested in any investments

The decision to keep this question in a slightly changed form results from similar reasons as the decision to keep the question no. 6 - currently the question is of auxiliary nature, supporting the modified segmentation in the case of an ambiguous attribution of the respondent to one of the behavioural segments. This question ends the part of the survey dedicated to energy-saving behaviours and questions relevant for behavioural segmentation of the respondents. As in the previous version of the questionnaire, questions about the characteristics of the household were located at the end of the questionnaire form.

7.1.2 Questions relevant for characteristics of end-users

This part of the questionnaire begins with the re-assurance of respondents that the information they provide is completely anonymous and will not be used to identify them, but only to be used for the modelling needs of eco-bot and verification that a wide variety of individuals and social groups have participated in the research.

The results obtained in the previous iteration of the study and later discussions with project partners resulted in some changes also in this part of the questionnaire form: some of the questions were changed, part of the question was left out. The first two questions in the new questionnaires relate to the number of people on the respondent's household. Question no. 1 concerns the number of inhabitants and respondents are asked to enter the appropriate number one. This is the only place in the questionnaire form where the respondent has to type something instead of selecting an available option. In the previous version of the questionnaire, both this question and the next one used the slider, which was completely abandoned in this version of questionnaire form.

Question no. 1 (Instruction: Please fill the appropriate number)

Number of people in the house:
[.....]

Question no. 2 (Instruction: Please indicate as many options as it is appropriate)

- What kind of people live in your household:
- d. 0-18 (kids)
 - e. 18-25 (students)
 - f. 26-40 (young adults/family members)
 - g. 41-64 (mature household)
 - h. 65+ (senior household)

Question no. 2 concerns the age of the respondent's household members. In the previous version of the questionnaire, information on the number and age of members of a given household was obtained just with one question. Due to the insufficient division of available age groups (in the old version of the question only 3 and in the new version 5) and the use of the slider (which is not the most intuitive form of providing answer), the current form of the question was prepared. The question about working hours of household members was also abandoned (in the assumption the this type of data will eventually be available from smart metering) as well as the questions about the health condition of household members (this question was a) considered too intrusive and b) preparation of guidelines for these categories of households goes beyond the assumptions of the current project). The next question concerns household income and has not changed in relation to the previous version of the questionnaire. The question is in three versions depending on the country of origin of the respondents and only one (the appropriate) option was available in each language version. The question was proposed as a segmenting question in the D2.3 report and will be used as such for the needs of the current questionnaire.

Question no. 3 ver. A: Spain (Instruction: Please select only one answer)

In which range can your household net income be found?

- e. 2500 EUR/month and more
- f. Between 1000 EUR and 2500 EUR per month
- g. 1000 EUR/month and less
- h. I refuse to answer

Question no. 3 ver. B: Germany (Instruction: Please select only one answer)

In which range can your household net income be found?

- e. 3600 EUR/month and more
- f. Between 2600 EUR and 3600EUR per month
- g. 2600 EUR/month and less
- h. I refuse to answer

Question no. 3 ver. C: UK (Instruction: Please select only one answer)

In which range can your household net income be found?

- a. 2499 GBP/month and more
- b. Between 1666 GBP and 2499 GBP per month
- c. 1666 GBP/month and less
- d. I refuse to answer

The last two questions (no. 4 concerning the education of the respondent and no. 5 concerning his or hers employment) to a large extent have not changed from the previous version of the questionnaire. The decision to leave them arises in the case of question no. 4 from the fact that in the previous modelling attempt it was indicated as relevant for the

respondents' characteristics, and for question no. 5 as an auxiliary question for determining the household income range in the case of respondent choosing " I refuse to answer " option.

Question no. 4 (Instruction: Please select only one answer)

What is your highest education qualification?

- i. Primary education
- j. Secondary education
- k. Bachelor or equivalent
- l. Master or equivalent
- m. Doctoral or equivalent
- n. Other

Question no.5 (Instruction: Please select only one answer)

What is your current employment status?

- h. Full-time employment
- i. Part-time employment
- j. Unemployed
- k. Self-employed
- l. Homemaker
- m. Student
- n. Retired

The questionnaire ends with a "thank-you" screen. Compared to the previous version, the new questionnaire form is shorter by 6 questions. The reduction of number of questions, along with their reformulation and simplification or reduction of available options, should shorten the expected average filling time, which in term should result in a lower rate of abandonment of the questionnaire by respondents.

The full questionnaire for individual consumers can be seen in ANNEX E.

7.2 Survey form for the commercial buildings segment: questions and expected results

As in the case of a questionnaire prepared for the segment of individual households, changes were made to the commercial sector questionnaire and data was collected again. As in the previous version of the questionnaire, two parts can be distinguished - the first one referring to the characteristics of respondents (or in this case the organization represented by respondents) and the second referring to energy behaviours and attitudes of respondents. Both parts of the amended questionnaire will be briefly described. At the very beginning, the respondent, as well as in the case of the household questionnaire sees the welcome screen and is informed about the purpose of the research, the anonymity of

the results, and the entities conducting the research. Then he or she is asked to agree to participate in the study (the mechanism and logic is the same as in the case of individual respondents). Respondents who agree are directed to the proper questionnaire, starting with the part on the characteristics.

7.2.1 Questions relevant for segmentation of end-users

Initial questions (from no. 1 till no. 5), in the part of the questionnaire regarding the characteristics of the respondent (country of origin, number of buildings handled, type of company represented by the respondent, number of employees in the company and type of buildings handled) have not been changed and either result from assumptions adopted in report D2.3 or are intended to prepare recommendations that are more tailored to the expectations of the end users.

Some of the questions previously in the section on respondents' organizations characteristics have been moved to the part concerning energy behaviours: questions 6, 7, 8 in the previous version of the questionnaire: concerning actions taken earlier in the organization, the average time it takes to implement an energy-saving measure and the expected payback time for the actions. These are again questions proposed in the D2.3 report and considered relevant to user characteristics. Questions from no. 9 till no.14 from the previous version of the questionnaire (regarding the approach to new technologies, preferred frequency of receiving information from the eco-bot and about some of the past activities concerning energy-saving measures) have been removed as less important, or possible to obtain from other sources and unnecessarily affecting the time needed to fill the form. To sum up, in the part directly concerning the characteristics of the organization represented by the respondent, only 5 questions from the previous version of the questionnaire remained (with minor modifications marked in red).

Question no. 1. (Instruction: Please select appropriate answers)

In which country do you handle your buildings?

- d. Spain
- e. Germany
- f. United Kingdom
- g. **Other**

Question no. 2. (Instruction: Please select only one answer)

How many buildings do you handle?

- g. Just one
- h. 2-10
- i. 11-50
- j. 51-99
- k. over 100
- l. I do not handle the buildings, but I am still interested

Question no. 3. (Instruction: Please select only one answer)

What kind of company are you working for?

- a. ESCO (Energy Services Company)
- b. Utility (Energy Producer/Distributor)
- c. OEM/ Hardware vendor
- d. Not an Energy-Related Company

Question no. 4. (Instruction: Please select only one answer)

How many employees work in your company?

- i. Just 1/ Freelancer
- j. 2-10
- k. 11-50
- l. 51-200
- m. 200-1.000
- n. 1.000-5.000
- o. 5.000-10.000
- p. over 10.000

Question no. 5. (Instruction: Please select only one answer)

Which type of buildings do you handle?

- s. Education facility
- t. Factory
- u. Health centre
- v. Hospital
- w. Hotel
- x. Housing
- y. Industrial warehouse
- z. Leisure facility
- aa. Library
- bb. Museum
- cc. Office building
- dd. Parking
- ee. Restaurant
- ff. Retail store
- gg. Small office
- hh. Sports facility
- ii. Supermarket
- jj. University
- kk. I do not handle the buildings, but I am still interested

7.2.2 Questions relevant for segmentation of end-users

Most changes were made in the part of the questionnaire concerning energy behaviours. This is partly due to the transfer of some of the questions about the organization's characteristics represented by the respondent to this part of the questionnaire and partly from the change of the questions that segment the respondents in terms of declared behaviours and motivations regarding the use of energy. As in the previous version of the questionnaire regarding the commercial segment, some segmentation and characterizing questions from the questionnaire on individual households were used in the part concerning past behaviours and their motivation. The first question in this part (question No. 6) is the modified version of the question x2 from the previous version of the questionnaire addressed to the commercial segment with minor changes - two options were added that were previously separate questions (marked in red) and the number of frequency options was reduced.

Question no. x2. (Instruction: Please select appropriate answer for listed actions, accordingly: 6-Always, 5-Often, 4-Occasionally, 3-Rarely, 2-Never/NA, 1-I do not know)						
How often and what kind of attempts to optimize electricity consumption in buildings you handle were undertaken in the past ?	6	5	4	3	2	1
Turn off lights and appliances when not in use						
Buy green energy from my utility provider						
Use energy-efficient bulbs						
Use energy-efficient office devices						
Change settings on the thermostat (turning up air-conditioner in the summer and turning down thermostat in winter)						
Consume less						
Do not leave devices on stand-by						
Changing the heating / cooling system to a more efficient one						
Change of the energy tariff to a more efficient one						
Close windows before turning on or up the heating						

Implement systems for monitoring energy behaviours of employees						
Applying for a subsidy for the implementation of energy optimization solutions						

Next question (no. 7) is the revised version of question x3 from the previous version of the questionnaire regarding the commercial segment, concerning the motivation (or lack of it) of not taking steps to optimize energy consumption in handled buildings. It should be stressed right away that due to the assumption about the use of behavioural segmentation prepared for the needs of the individual consumer sector, new segmenting questions are a reflection of the previously described household survey. And as mentioned before, these questions were supplemented with questions characterizing the information about the commercial segment transferred from the first part of the previous version of the commercial sector questionnaire. All current questions will be quoted here with an indication of the assumed order, but due to the fact that the justification for their placement and logic have already been described previously in other parts of the report their detailed description will not be repeated here. Instead, it should be indicated where the description of a given question should be sought. And so: the current question no. 7 is question no. 7 from the new version of the questionnaire for individual households, question no. 8 is question no. 3 from the new version of the questionnaire for individual households, question no. 9 is modified question no. 6 from the previous version of the questionnaire for the commercial sector, question no. 10 is question no. x4 from the previous version of the questionnaire for the commercial sector, question no. 11 is question no. 7 from the previous version of the questionnaire for the commercial sector, question no. 12 is question no. 5 from the new version of the questionnaire for individual households, question no. 13 is question no. 8 from the previous version of the questionnaire for the commercial sector, question no. 14 is question no. 8 from the new version of the individual household questionnaire.

Question no. 7. (Instruction: Please indicate the three most important reasons)

What were the reasons for not attempting to optimize electricity consumption?

- a. Lack of time
- b. Too high cost/lack of money
- c. Lack of information/lack of knowledge
- d. Lack of practical or technical support
- e. Lack of opportunity for change
- f. Change of priorities
- g. It is too complicated to do it
- h. I did not think about saving energy

Question no. 8. (Instruction: Please select only one answer)

Which of the following statements regarding energy use you can most relate to?

- a. I think about the environment, so I feel obliged to save energy
- b. I want to save money on my energy bill and it motivates me
- c. Green is new black and I want to help the planet
- d. I like convenient solutions that can be easily applied
- e. I am satisfied and do not worry about my current energy use

Question no. 9. (Instruction: Please select only one answer)

Which of the following energy saving measures could your organization easily afford an investment in?

- h. Replacement of equipment's for more efficient ones (Light bulbs with LED bulbs, new boilers, heat recovery etc)
- i. Apply Free Cooling
- j. Stop stand-by consumptions and turn off lights when not in use
- k. Focus consumption on off-peak hour
- l. Retrofit the building envelope
- m. None of the above

Question no. 10 (Instruction: Please select only one answer)

Would you be interested in adopting energy saving measures if they would require change of the behaviours in your organizations?

- f. Yes, I would definitely do so to protect the environment
- g. Yes, but only if it would reduce my bills
- h. Yes, but only if it will improve the value of my buildings
- i. Yes, but only if they are easy to implement
- j. No, I am not interested in any changes

Question no. 11. (Instruction: Please select only one answer)

How long does it take to adopt a scope energy saving measure in one of the buildings that you handle?

- f. Less than one week
- g. Between one and four weeks
- h. Between one month and 5 months
- i. More than 6 months
- j. Don't know

Question no. 12. (Instruction: Please select only one answer)

Which of the following statements about energy saving applies to you:

- a. I save energy because my social group tells me how (or tells me to)
- b. I am well informed and feel motivated, thus I save
- c. I do not know how but I would like to save energy
- d. I save energy because I know it will reduce my bills
- e. I do not really thought about how to save energy

Question no. 13. (Instruction: Please select only one answer)

What is the expected time of return on energy efficiency investments in your organization ?

- h. Less than six months
- i. Between six and twelve months
- j. Between one year and five years
- k. Between five years and ten years
- l. More than ten years
- m. Time of return is not important
- n. Don't know

Question no. 14. (Instruction: Please select only one answer)

If I think about saving the energy, than:

- a. I want to use electricity from renewable sources
- b. I feel that energy savings suits my lifestyle
- c. I do not feel like I need to change anything
- d. I am concerned about rising energy bills
- e. I would like to use public aid

The questionnaire ends with the “thank you for taking part in the survey” screen.

The full questionnaire for commercial users can be seen in ANNEX F.

8. Report on the results of the repeated online surveys

8.1 Characteristic of the survey and selection of the sample

Similarly to the previous survey, this study was also carried out using a standardized CAWI method exploiting a questionnaire form for individual and commercial users, described in section 7 in this report.

The selection of the research sample also remained the same: in a targeted manner, in accordance with the assumptions of the non-random selection of the respondents' sample - so as to ensure that the intended objectives of the project are achieved. The purposive sampling method was chosen.

Field research was conducted among the same group - clients of consortium partners in countries that will participate in the pilot phase of the eco-bot application: in Germany, Great Britain and Spain.

The survey on both individual and commercial customers were repeated.

This time the survey was conducted from the beginning of November 2018 to mid-January 2019, while the platform on which the questionnaires were placed was changed - so that it would meet the respondents' requirements more. SurveyMonkey.com was selected. As the previous survey showed, sometimes the respondents had problems handle and navigate through the cards of the previous platform. This could have an impact on the number and quality of the responses obtained. This time, a platform was chosen that offered respondents support in national languages, so as to avoid ambiguity or misunderstanding how to complete the questionnaire. The platform proved to be easy and intuitive to use, hence it can be assumed that the authors had avoid making the same mistake.

The following is a brief description of the survey:

I. Also in this edition of the study, two versions of the questionnaire for **individual consumers** were prepared: the Catalan version, where 125 filled questionnaires were obtained and the German version which was answered by 26 people.

Catalan consumers became interested in the survey between January 07 and January 14., their average time of completing the questionnaire was: 9 minutes and achieved a completion rate level of 86%.

German respondents were interested in the survey between December 12 and January 04. Also here the average time of completing the questionnaire was: 9 minutes but German consumers achieved only 73% of completion rate level.

II. For commercial customers, a Spanish and English (for customers located in Great Britain) questionnaire was prepared. Unfortunately, in this edition of the survey, we managed to receive a total of only 26 completed commercial consumer questionnaires.

Spanish consumers became interested in the survey between November 08 and November 26, while the British filled the survey between November 09 and November 14. In both versions, the average time of completing the questionnaire was: 9 minutes and an achieved completion rate level of 80%.

After receiving the results of surveys of commercial clients, the authors together with project partners re-analyzed the concept of the need to build this type of model for business clients taking into account the practical approach resulting in needs of these enterprises. During the discussion and analysis of the first results, attention was paid to the limitations of this approach, which were briefly presented here.

Limitations of this approach: it is necessary to raise doubts here whether the declared behaviour of the respondent representing the given organization will significantly translate into activities directed to more effective energy management undertaken in the organization itself or in organizations that are supported by the organization represented by the respondent. The commercial sector is very diverse in many respects (size of entities either in term of occupied space or the number of employees employed, types of business, legal conditions) and as already indicated in the report D2.2 developing an universal model for the whole commercial sector is a very difficult undertaking. In addition, in the case of behaviours related to energy saving in enterprises, it should be remembered that these activities depend to a large extent on: a) behaviour of employees who can and should be trained and educated, but these activities will be more or less effective depending on individual predispositions, beliefs or whether the requirements of a given workplace are; or b) from factors beyond the control of the institution itself - e.g. energy consumption in a hotel will depend to a certain extent on the behaviour of clients / hotel guests and of course one can and should try to educate / encourage guests to undertake more energy-saving behaviours (e.g. information encouraging the re-use of towels, shut-off systems for power supply if the key card is not put in the right slot), but again the effectiveness of these activities will be very diverse and hard to predict and measure.

Taking into account the results of the research, the following preliminary conclusions were formulated:

I. The collected material is sufficient to build a stable classification model for individual consumers.

Based on the results of the research, an individual model of eco-bot customer behaviour will be built, and recommendations based on the division of clients will be developed. The use of recommendations by customers and their hierarchy and allocation to particular segmentation groups will be evaluated during the pilotage. Then, taking into account the observations from the pilotage phase and received additional information, both the model and the recommendations will be modified accordingly.

II. Considering the limitations and doubts arising in connection with the classification of commercial consumers, it was decided that this type of clients would be divided according to other criteria that would be more relevant to the sector's specificity and needs, such as type of business, size of institution and number of employment, etc.

However, taking into account the objectives and assumptions of the project for this segment, recommendations such as: investment, related to the change or modification of material components of enterprises and behavioural related to the expected change in employee behaviour will be prepared to achieve the goals of saving environmental resources as well as educational goals.

The use of recommendations prepared on the basis of the research results achieved will be monitored during the pilot study in order to evaluate them in terms of their suitability and to meet the participants' needs as well as project goals.

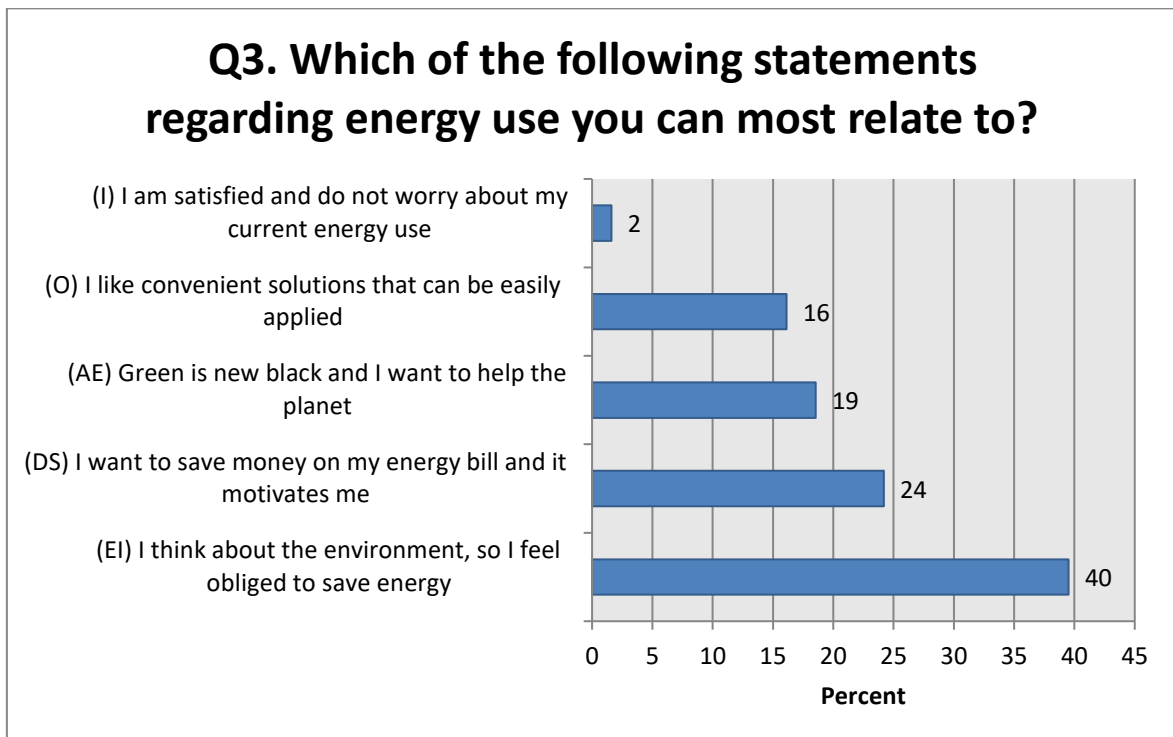
III. Modification of interview questionnaires, shortening them was a good step, because it reduced the time of completing the questionnaire, which translated into more careful filling them in by respondents and obtaining more reliable results.

IV. The intensification of promotional and information activities by the partners translated into a larger number of completed surveys of individual customers which was crucial for further project work.

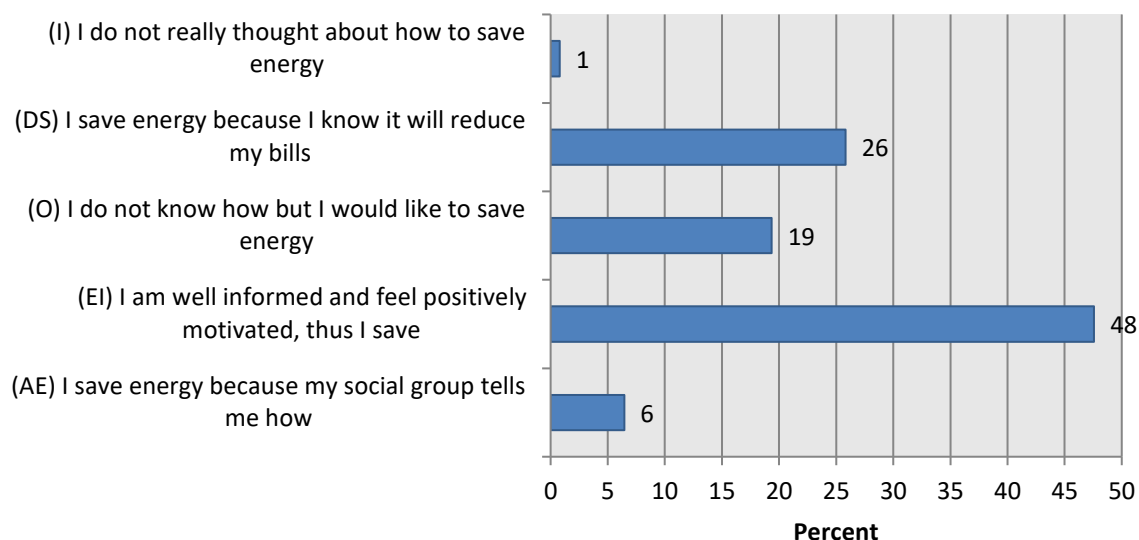
8.2 Obtained results of research on segmented questions for individual energy consumers

The main objective of the study was to obtain a clear division of energy consumers - eco-bot customers according to the modified segmentation described in Chapter 6 of this report. Obtaining the right representation in the segments allows the creation of a training set for the model - so that the model can learn the appropriate allocation of a new user to the appropriate segment in the assumed segmentation. In order to make it possible, the segmenting questions should first be changed so that their assumed answer possibilities would reflect the assumptions of segmentation. Therefore, the authors changed the segmenting questions, which in the new survey were questions: 3,5,6, 9 and 11. However, in order to verify the thesis about the need to change the segmentation and adapt it to the needs of eco-bot customers, it was decided to leave in the new form 2 questions reflecting the assumptions of the original segmentation. These are questions: 6 and 11.

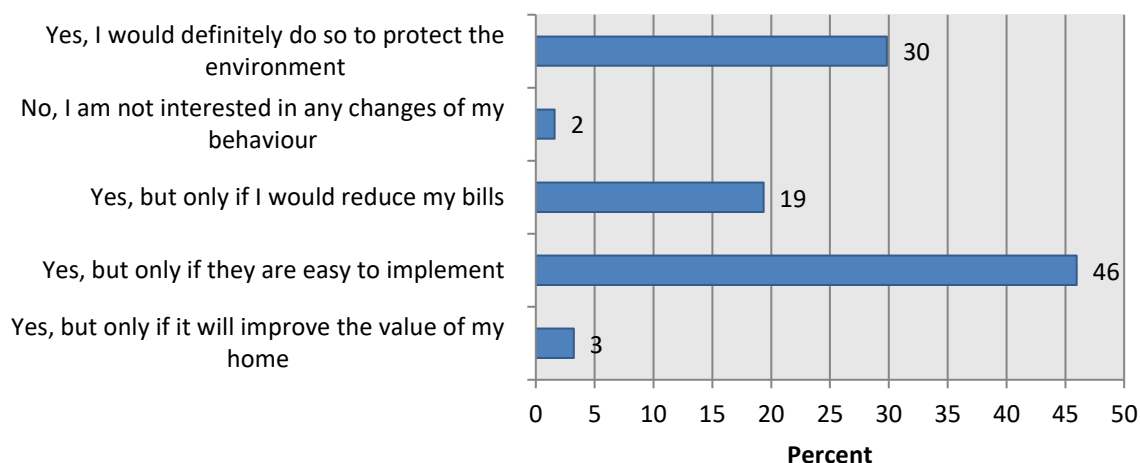
Distributions of responses to individual segmenting questions are presented in the following charts. To better illustrate the results, the charts indicate the segmentation group that has been assigned to individual responses (in brackets).



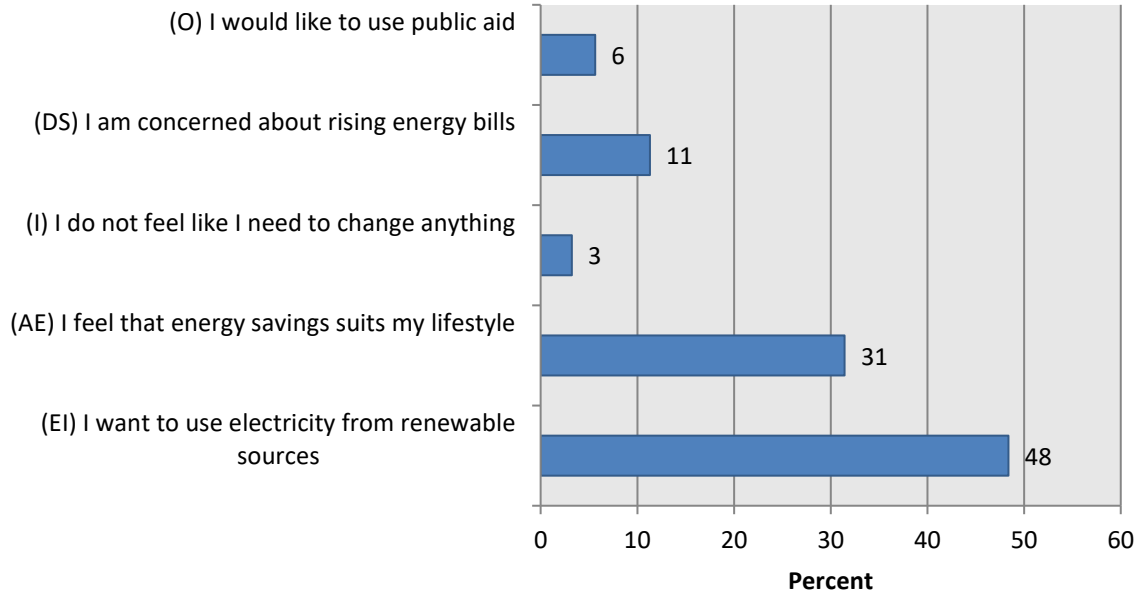
Q5. Which of the following statements about energy saving applies to you



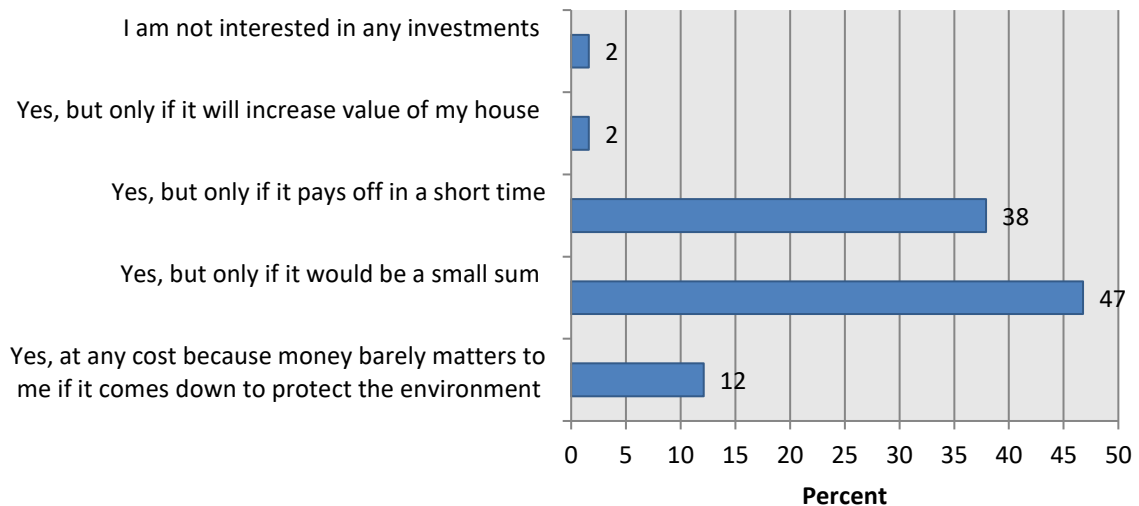
Q6. Would you be interested in adopting energy saving measures if they would require change of behaviour of people living in your household?



Q9. If I think about saving the energy, than



Q11. Would you be interested in adopting energy saving measures if they require you to make investments?



Similarly to the previous survey, also in this case, in each question the respondent had 5 possible options, of which he should choose only one. Each answer corresponded to one of the types of consumers described in the segmentation. The respondent here also chooses the answer that best suits his attitude, motivations or beliefs and is assigned to the relevant segment on this basis. By creating answers to the segmentation questions that the respondents could have chosen, we tried to choose one dominant feature that could be assigned to a particular sector, and which best responded to the character of the entire segment. Hence, for the Ecological Idealist segment, the main motive is the concern for the environment as such, high ecological awareness without additional motives. For the Aspiring Ecologist segment, such a feature is to follow fashion and choices in line with lifestyle, for the Dedicated Saver segment, it is usually a financial motivation, while for the Opportunist sector easiness to implement of the desired changes from an ecological point of view is the proper motivation.

As the distribution of respondents' answers in the graphs shows, the thesis that individual consumers do not show motivation to pro-ecological behaviour related to home improvements or to increasing the value of their households has proved successful. In the 6th question left according to the first segmentation, this option was marked by only 3% of respondents, whereas in question 11th only for 2% of consumers the increase in the value of the home would be the reason for undertaking investments to increase energy efficiency. Such results indicate the small significance of this factor, regardless of the number of participants in the study and the number of responses received.

In other segmenting questions, structured in accordance with the assumptions of the new segmentation, the distribution of responses is fairly regular, which shows that the assumptions were selected in such a way as to anticipate all potential responses and to best reflect respondents' thinking in the context of ecological problems.

In the responses obtained, it can be clearly seen that appeared new consumer sector, motivated for example by social groups or beliefs, resulting from lifestyle (I feel that energy savings suits my lifestyle – 31%) or fashion (Green is new black and I want to help the planet - 19%), which was not visible in the previous survey and segmentation.

Also here, it can be seen trends from the previous survey, where motivations related to saving money or the ease of introducing environmentally friendly solutions stand out. Of course, the ideological approach prevails - but this may also result from the tendency of subjective assessment of own motivations by respondents or willingness to show themselves in a better light (in line with the global trends).

As a result of the received responses, the following distribution of respondents assigned to particular segments was obtained (see fig.4).

1. **Ecological Idealist (EI)– 50%**
2. **Aspiring Ecologist (AE)– 11%**
3. **Dedicated Saver (DS)– 20%**
4. **Opportunist (O)– 19%**
5. **Indifferent (I)– 0%**

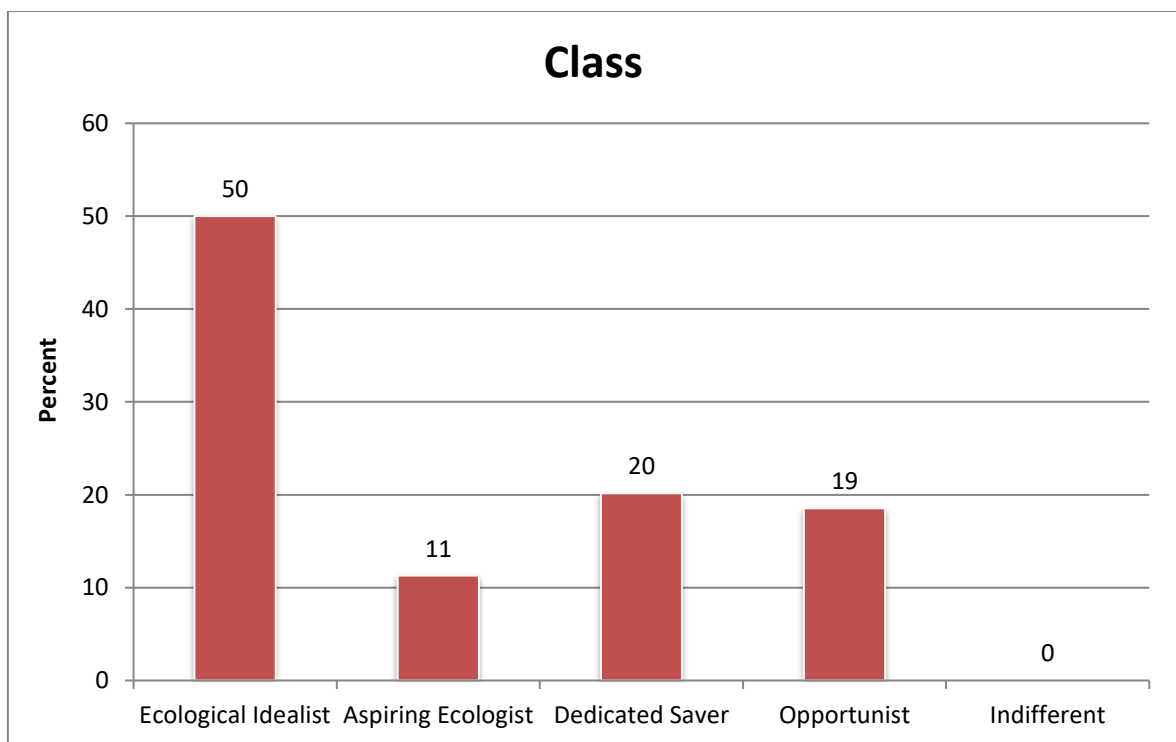


Figure 4. Distribution of consumers between the new segments on the basis of the results of surveys

As can be seen in Chart 4, it dominates allocation of consumers to segments with high or very high ecological awareness. The results of the study are convergent to the results of research of other scientists, including those who the previous chapters of this report were referred to. No person was assigned to the Indifferent sector, as the participants of the survey were existing eco-bot partners clients, hence it can be assumed that such people, if they wanted to complete the questionnaire, are interested in the problems presented in the

survey. In addition, they are also aware of environmental problems at least in the slightest, and want to change their behaviour so as to be able to save energy. However, the authors of the report assume that such people may appear in the future, hence there is a need to prepare recommendations for this type of consumers in line with the project's objectives. These guidelines can be used, for example, to promote a project in the mass media or in information materials.

As shown by the results and the allocation to sectors, re-conducting the research and modifying the segmentation has fulfilled its role and it is now possible to build a behavioural model for individual customers, which will be described in detail in the report 3.2.

The authors analyzed the results of the research also in terms of consumer characteristics assigned to particular segments. The most important conclusions can be summarized as follows:

1. Ecological Idealist (EI)

This segment is dominated by 2 or 4 person households (63% of indications). In addition, the dominant group are people aged 41-64, with low income (61% of indications in this segment) with a bachelor's or equivalent education level (45%), working full-time (73%). There is a group of 13% of respondents indicating self-employment in comparison with other segments, where this form of employment is unnoticeable.

This confirms the thesis that education is one of the key determinants of the level of ecological awareness. Among the respondents in the eco-bot survey in the EI sector, there were mainly people with higher education, only 15% of respondents indicated the level of secondary or lower education. However, the thesis concerning income is not confirmed here, the majority of respondents qualified for this sector (on the basis of other factors) indicated low income, only 11% of respondents reported high income.

2. Aspiring Ecologist (AE)

This segment, similarly to the previous one, characterizes a household that dwells by 2, 3 or 4 people, where the dominant age group is people aged 41-64, however, respondents classified here more often indicate apart from low (57%) also average income (43%).

Declared education is usually the level of higher education (64%), but unlike the EI, aspiring environmentalists also show the secondary level of education achieved - 36% indications. The full form of employment also significantly prevails here (86%).

3. Dedicated Saver (DS)

In this sector 4 people dominate in the household, but there also happened to be 5 people or 1 person. When it comes to this factor this sector is the most evenly distributed. Also the age group in these households is the most diverse, as can be seen in the figure 5. In financial terms, here, consumers declare having low (48%) or medium (40%) income like in the previous sectors. The people who are qualified here usually declare having a higher education (Bachelor or equivalent – 48%; Master or equivalent – 12%; Doctoral or equivalent – 8%). This sector is also homogeneous in terms of the declared form of employment, as many as 92% of respondents indicated full-time employment.

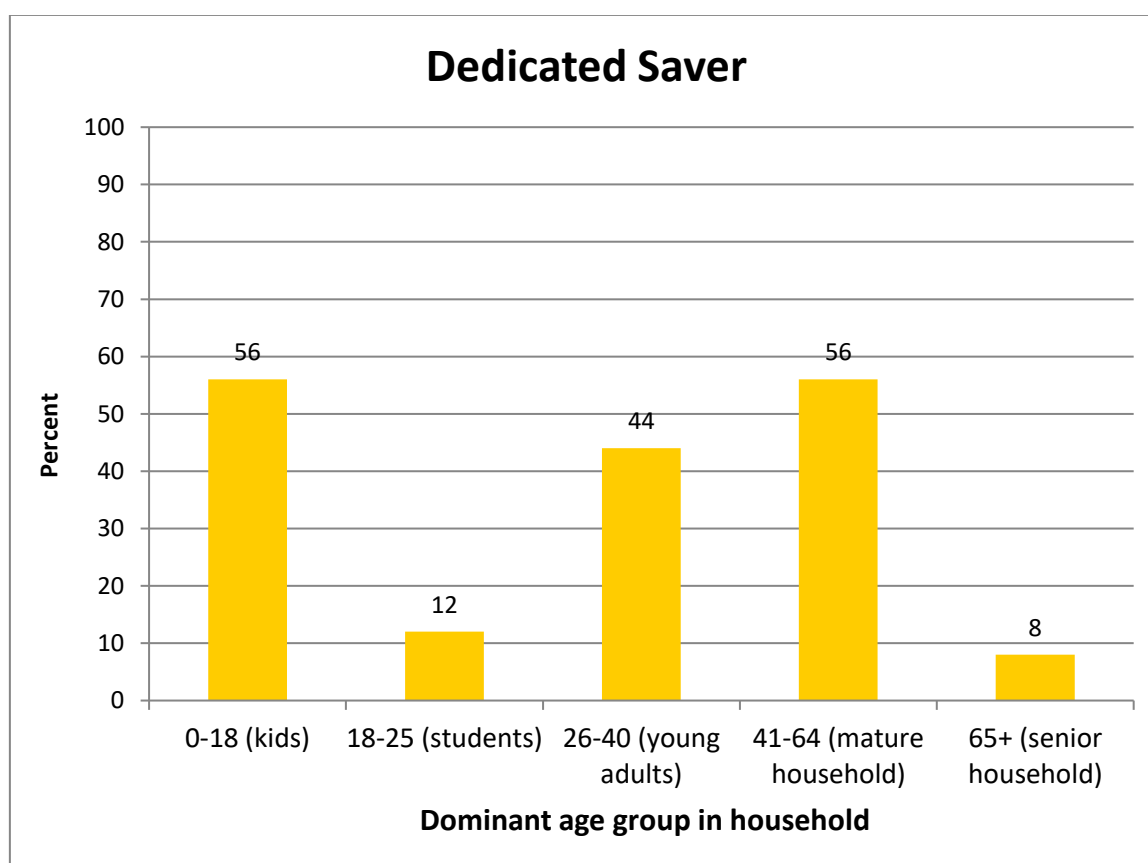


Figure 5. Respondents' answers assigned to the Dedicated Server sector regarding the dominant age group in household

4. Opportunist (O)

This consumer sector is the most diverse in terms of the characteristics of the people classified there. As regards the size of the population of the household, the indications of 4

people predominate, however, in the case of the dominant age group, as in the previous sectors, the majority of indications falls on the 41-64 group - 61%. Moreover this sector also includes students - 52%. It is significant that seniors, i.e. people aged 65+, did not get into this group.

Income shown by respondents here is almost evenly distributed between low (48%) and medium (30%). The level of education achieved here is mainly the bachelor's degree (61%), whereas, as can be deduced from previous factors, the form of employment is the most diversified among sectors. As can be seen in Figure 5, although the form of full-time employment dominates (65%), other options such as: student status, part-time employment and self employment were also marked in this sector.

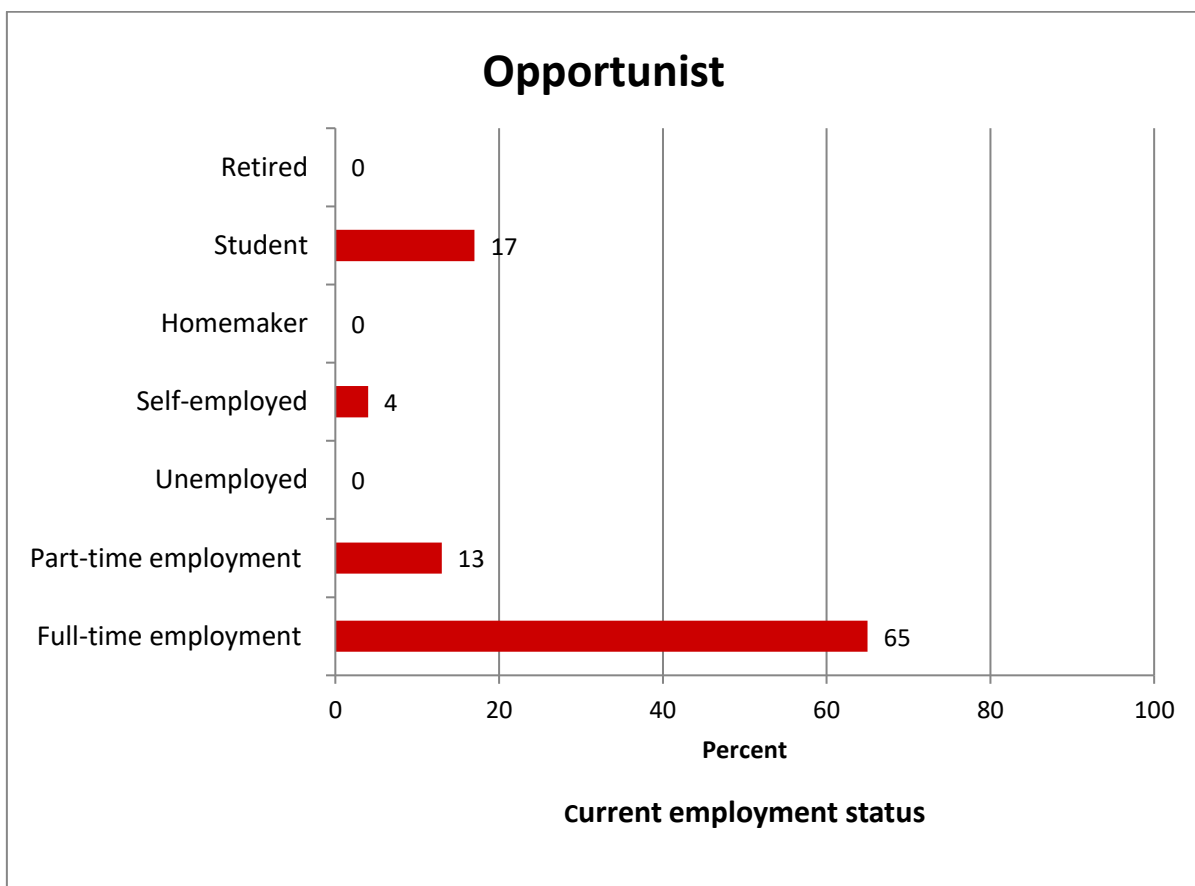


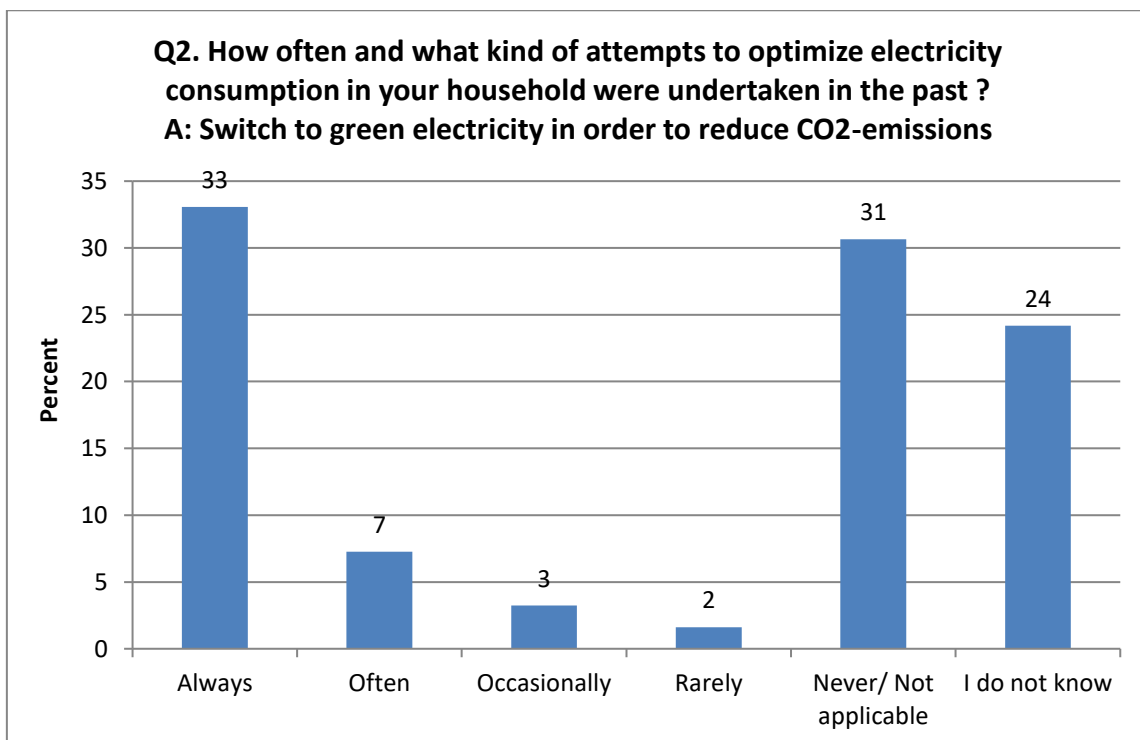
Figure 6. Respondents' answers assigned to the Opportunist sector regarding the current employment status.

Since no one has been classified in the Indifferent sector, there is no data that could characterize this sector. It can only be based on similarly carried out studies in which scientists state that the sector is characterized by low social, professional and educational status.

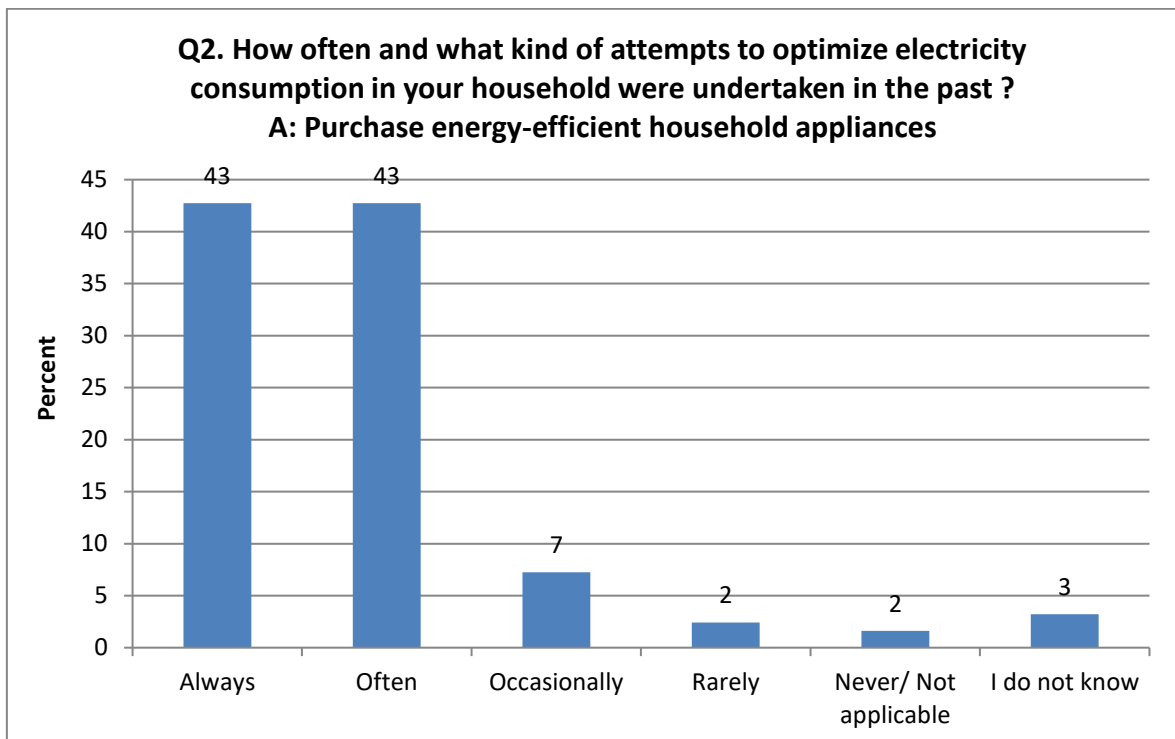
8.3 Presentation of the model-sensitive questions characterizing individual consumers obtained during the second examination

This part of the report will present the most important questions from the point of view of building the model, which will be used to adequately classify consumers to the relevant segmentation groups. Based on the results of the survey constructed on the assumptions of the modified segmentation and receiving more questionnaire returns, the model indicated completely different questions as important than those selected after the first edition of the study (for comparison see Chapter 5.3). Analyzing the obtained material, the authors stated that the questions identified by the model as important for classification are those where respondents' answers differed most. Because these questions have to be asked to new users of the eco-bot application, in order to correctly classify them, the authors limited their number to the most important eight indicated by the model. Moreover the authors also selected two additional questions, according to the assumed eco-bot customer engagement strategy, about the achieved income and the type of property ownership .

The following is the distribution of the answers of all respondents to the model questions, which were presented according to the hierarchy of importance: from the most significant to the least important. It should be noted that new application users will have to answer all these questions at the same time, at the beginning of work with the application, so that the assignment to a particular segment by the model will correct.

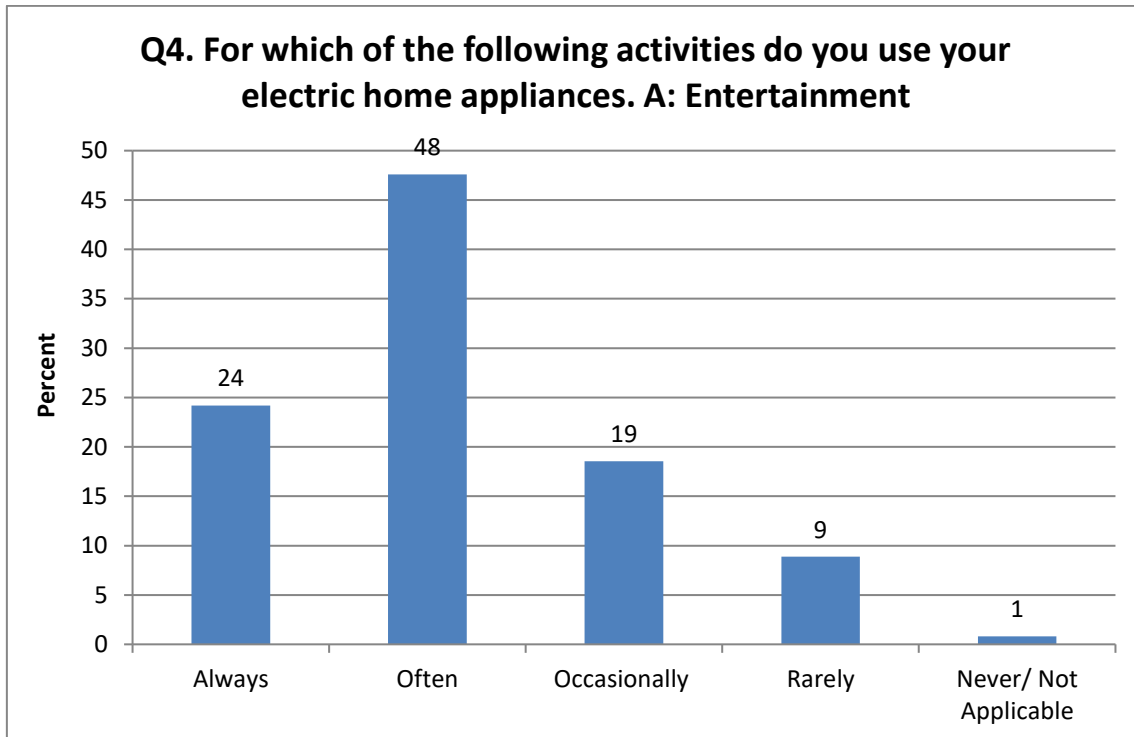


Analyzing this question in terms of assigning respondents to specific sectors, it can be seen that consumers qualified for the Ecological Idealist sector answered most of this question: always (37%) or never / not applicable (39%). In the Aspiring Ecologist sector, people who were qualified there predominantly indicated the answer: always - 57%, while in Dedicated Saver people mainly answers: I do not know - 36%, although in this sector there were also a lot of people whose answers would indicate that this solution was already introduced in their household. The Opportunist sector is mainly people who indicated responses I do not know - 43% and never/not applicable - 39%, which agrees with their segmentation characteristics.



The second question in order of importance chosen by the model is another option of the second question from the questionnaire: Q2. How often and what kind of attempts to optimize electricity consumption in your household were undertaken in the past ? A: Purchase energy-efficient household appliances. As the chart shows, most respondents have already applied this solution (86%), however the model managed to distinguish individual segments and, judging from the distribution of responses, in the Dedicated Saver sector people whose answers mainly indicated the often option (60%) were included, while people who also marked other answer options than: always and often fell into the Opportunist sector.

Another question chosen by the model is the type of activity in which respondents consume energy. The entertainment option was chosen as a differentiating sector.

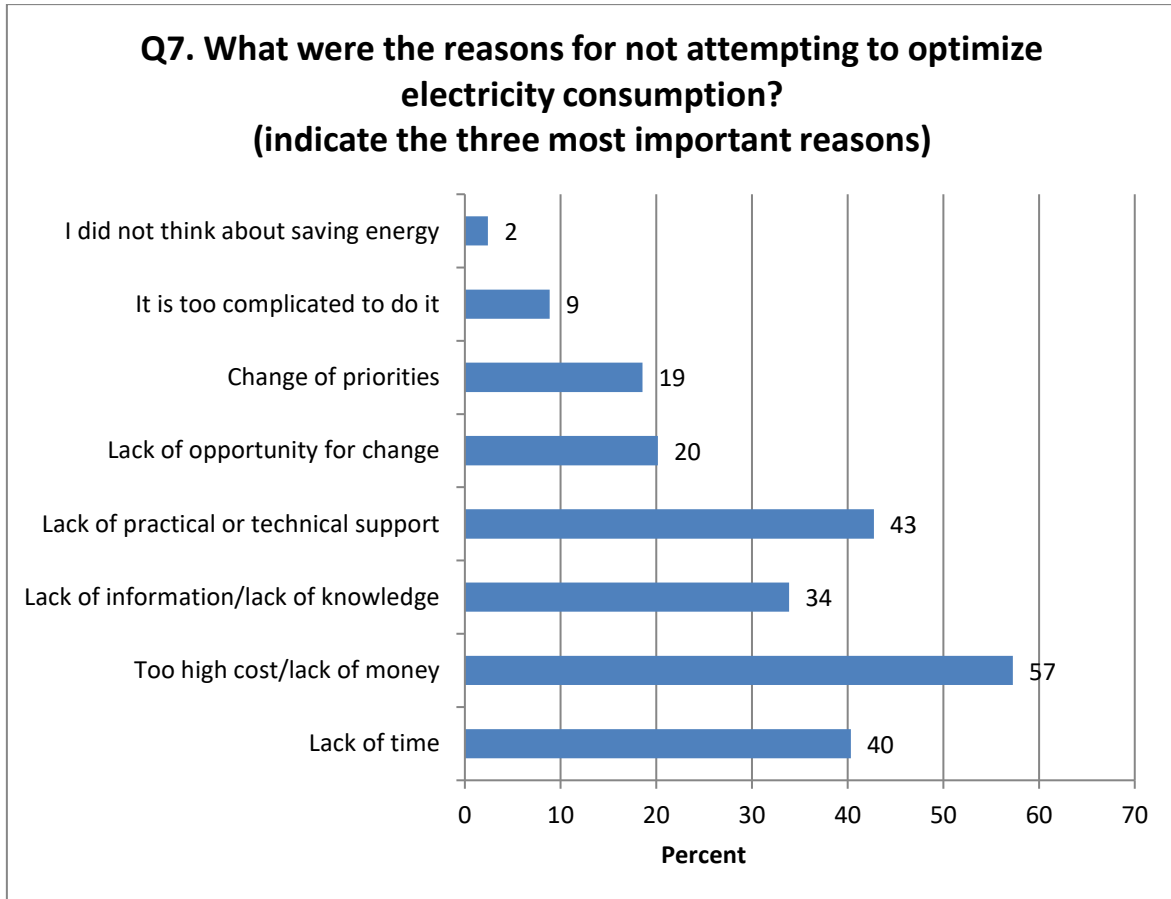


In the remaining options of the answer in this question (4 from the form), which the model did not take into account, respondents' answers were uniformly distributed. Either respondents pointed out that often or always they use energy to perform particular activities or that they never or rarely. Only the option: work at home, stand out from this formula and here respondents' answers were spreading regularly, although the model did not distinguish this option. How the persons have been qualified for particular sectors based on this question is shown in the table below.

Q4. For which of the following activities do you use your electric home appliances:					
Entertainment	Always	Often	Occasional ly	Rarely	Never/ Not Applicable
Ecological Idealist	34	55	6	3	2
Aspiring Ecologist	21	50	14	0	14
Dedicated Saver	32	52	8	4	4
Opportunist	39	35	4	9	13

The next two important questions selected by the model are two options from questions 7 from the form regarding the reasons for not optimizing the consumption of electricity in the household. The important responses were those indicating high costs or lack of funds and answers indicating that such optimization is too complicated to do it.

This is where all respondents' answers to this question were presented, as it also seems to be important for the development of recommendations for future eco-bot users.



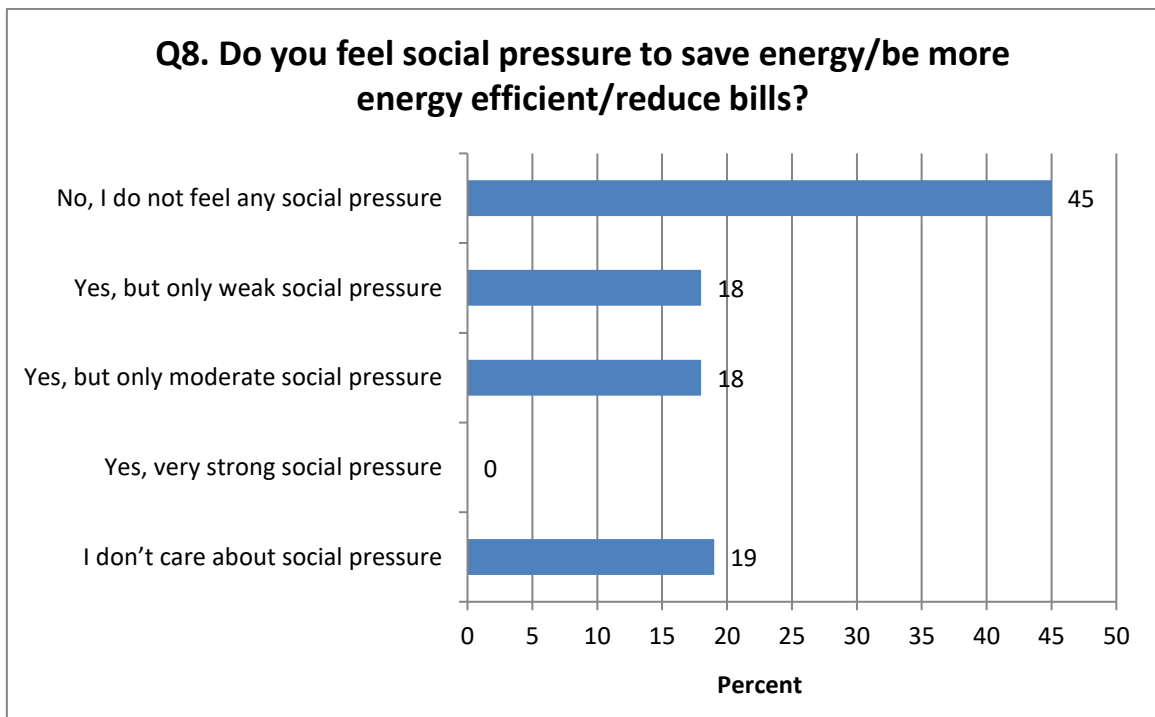
The main barrier to not making the optimization of electricity consumption indicated by the respondents were high costs or lack of funds. This is not surprising, because according to demographic data from the survey, the majority of respondents (56%) indicated that they have low income. 31% of them declared average income, while only 9% high income.

In the case of income, the model classify respondents to the relevant segments in the manner of the following: the majority of people pointing this option as a barrier was assigned into Dedicated Saver sector (also here the model classified consumers according to the assumed characterisation of the segments - it can therefore be assumed that the model will classify users in a proper way). In other sectors, the model assigned respondents fairly evenly, although in the sector Opportunist the least people who indicated this barrier were found.

For eco-bot application important information is the respondents' identification of barriers related to the lack of practical or technical support (43%) as well as the lack of information and knowledge (34%). The main purpose of the application is to educate and inform

consumers as well as help them in reducing energy consumption. As the research results show, despite the steady increase in awareness, knowledge about effective ways to save energy is still not common. There is still a need for education and good practices. The eco-bot project can provide consumers with a tool that will eliminate barriers of this type. Answers pointing "the lack of time" or "too complicated to do" show that there are people who should be encouraged to change behaviour to a more pro-ecological one, by emphasizing the ease of applying certain solutions. In the case of eco-bot such people should be included in the Opportunist segment, where recommendations will be prepared in a way that emphasizes the possibility of making changes easily in a short time. Also in this case, the model correctly identified the sectors and respondents indicating the barrier of "too complicated" assigned to the Opportunist sector.

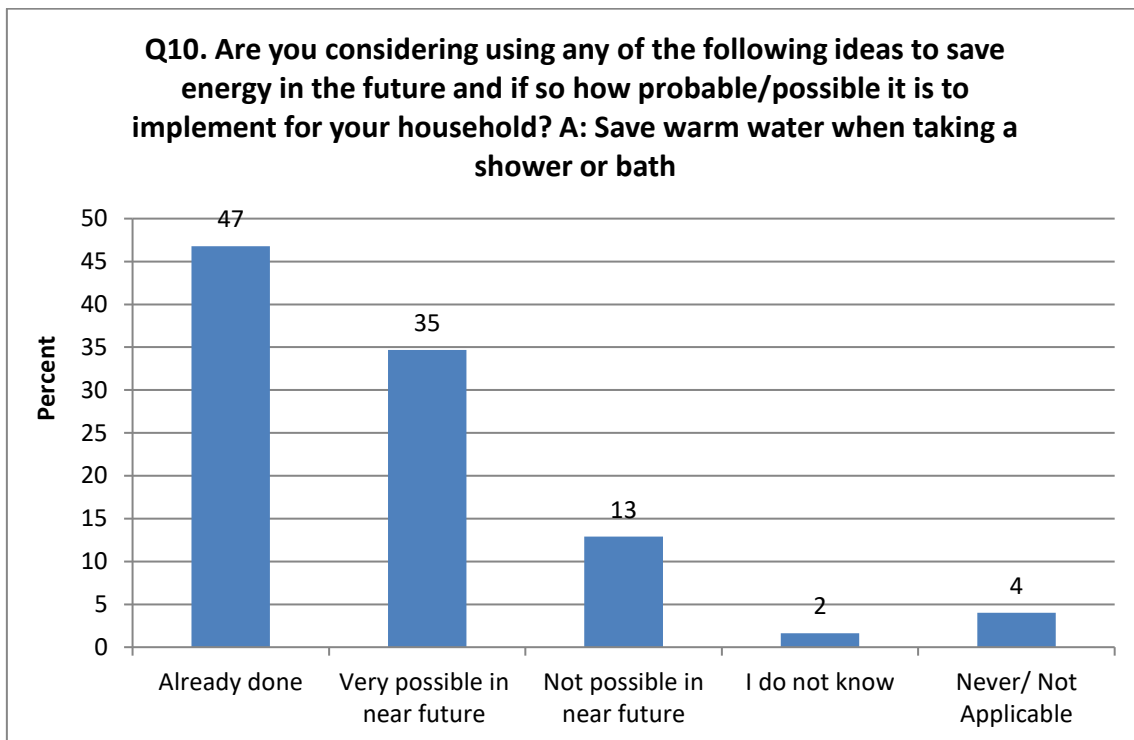
A very important question differentiating the consumer sectors was the question about the impact of social groups (8th question from the form). It can be assumed that this question helps to recognize people belonging to the Aspiring Ecologist segment. Although, as the data show, most respondents do not feel social pressure or do not attach importance to it, however, 42% of people who feel this pressure are attributed to the Aspiring Ecologist sector. It can be assumed that for this sector, social acceptance is of great significance.



According to the authors, the impact (or lack thereof) of social groups on people's decisions is one of the most important (apart from income, education, age and number of people in the household) factors that can change the behaviour of consumers. It is very common to refer to the opinions of others regarding the assessment of the correctness of one's

behaviour, especially in a situation of uncertainty, and when the opinion-makers are people from the same social group (clancy 202, s. 111). The family is an extremely important factor in shaping the behaviour of the individual, however, apart from the influence of the family on consumer behaviour, the role of relatives, friends and groups with which a given person comes into contact is also visible. It should be noted that a special opinion-forming role is attributed to the leading groups. Their significant role lies in the fact that the consumer imitates the conduct of people from his surroundings, which he respects, admires and with whom he would like to identify. That's why he compares his own lifestyle to those social groups he cares about.

Another important variable from the point of view of the eco-bot project is to answer to question 10 from the form regarding the possibility of saving hot water during a shower or bath. The model considered this option as differentiating consumers between sectors. The distribution of answers given by respondents is presented below.

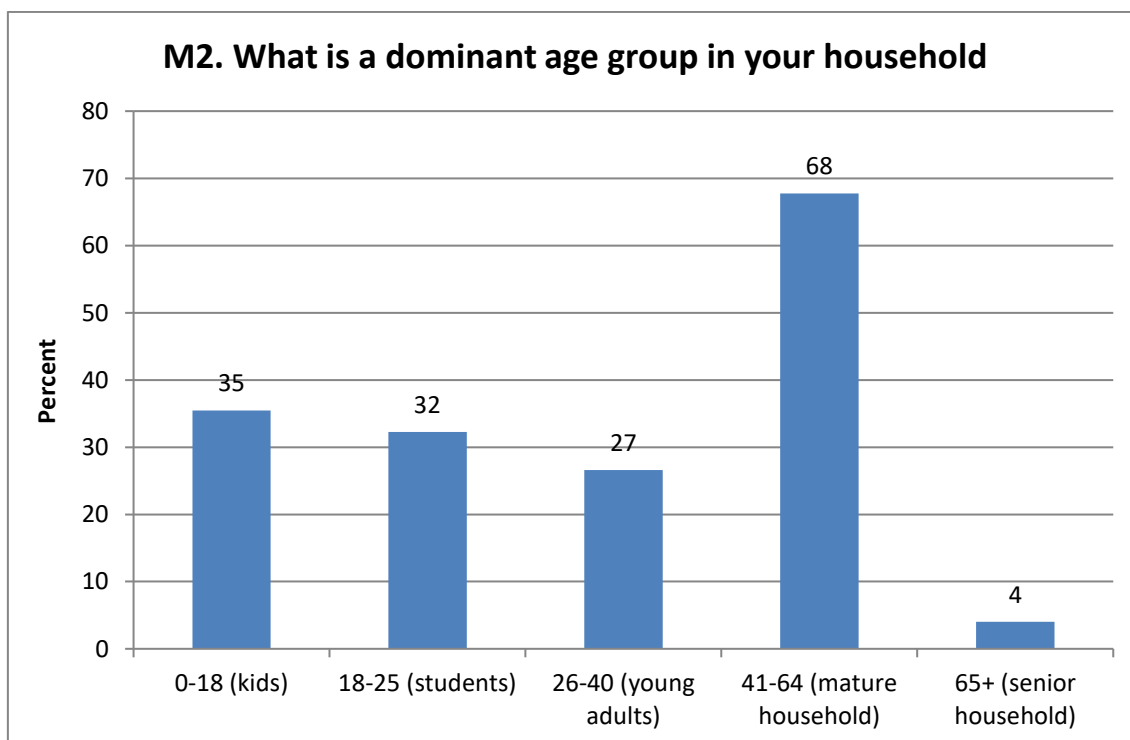


Due to the fact that for the development of recommendations for eco-bot users, the declarations of respondents regarding the ways of saving energy implemented in the future are important, the authors present below all the answers options in tabular form. In addition, for better visualization, fields with the majority of responses are marked in the table in light green.

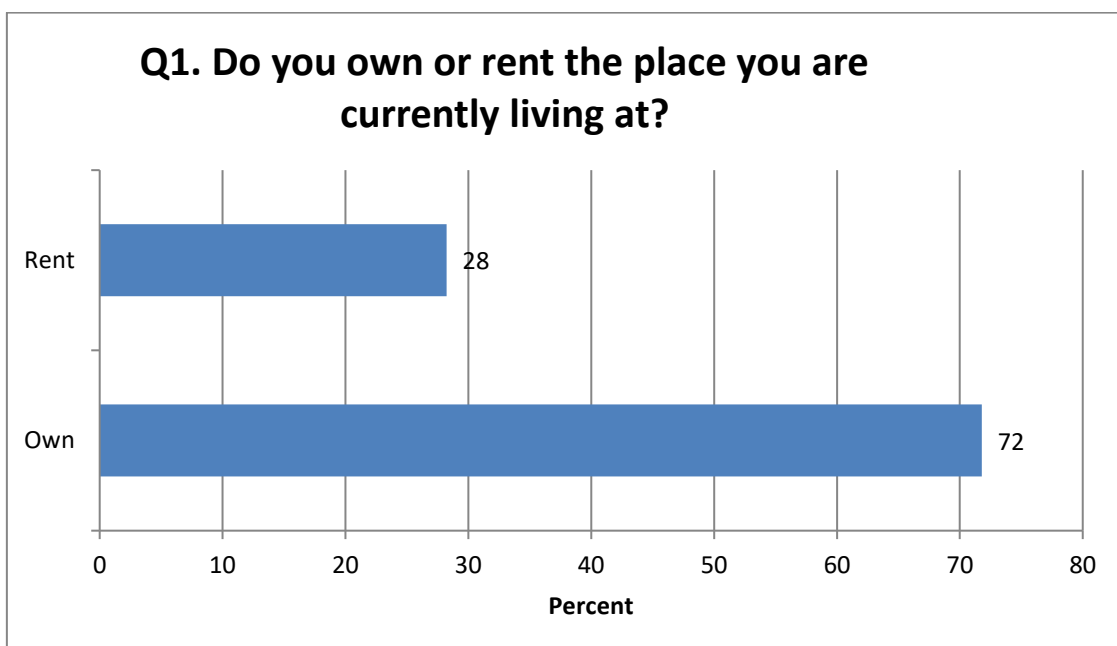
Q10. Are you considering using any of the following ideas to save energy in the future and if so how probable/possible it is to implement for your household? (percentage of responses given)					
	Already done	Very possible in near future	Not possible in near future	I do not know	Never/ Not Applicable
Turn off lights and appliances when not in use	71	26	2	1	1
Switch to green electricity in order to reduce CO2-emissions	39	40	1	9	11
Use energy-efficient bulbs	60	36	1	1	2
Reduce the heating temperature when leave the house in winter or increase the temperature on the air conditioner when leave the house in summer	69	21	2	2	7
Reduce the use of home appliances	38	45	9	6	2
Do not leave devices on stand-by	19	64	5	8	4
Change the heating / cooling system to a more efficient one	20	32	10	18	20
Use home appliances mainly during off-peak hours	13	42	14	15	16
Close windows before turning on or up the heating	88	10	1	2	0
Boil the kettle with just the amount of water you need	71	22	3	1	3
Prefer line drying than tumble drying	69	19	3	3	5
Wash clothes at 30 degrees or lower	54	34	5	3	4
Save warm water when taking a shower or bath	47	35	13	2	4
Invest in renewable energy sources such as solar panels, geothermal energy or wind energy	9	53	10	20	8
Use home insulation	28	41	6	10	14
Purchase energy-efficient household appliances	52	42	1	2	3

As the data in the table shows, the majority of respondents have either already applied the proposed saving methods or are considering their application in the near future, which is very promising. Of the 16 proposed options, as many as 9 were used by respondents in their households. Most often these are simple activities such as turning off light and devices when they are not used; use of energy-saving light bulbs; closing the windows before switching on the heating or boiling only the amount of water that is needed. It can also be noted that the majority of respondents are considering using these energy-saving methods in the near future which they have not yet applied. Regarding energy saving methods, more than 10% of respondents think that it is impossible to apply (the fields marked in red in the table) methods that mainly require quite often very expensive financial investments. Expression of such opinions by respondents is clearly linked to the level of declared income. Although judging by the dominant number of respondents who declared low incomes, it would be expected that the number of indications of energy saving methods impossible to implement would be greater.

For the model, an important question turned out to be the age of the household members living in it. The answer option 18-25 years is, according to the model, the distinguishing factor among individual sectors. However, as it can be seen in the graph, the majority of respondents in the survey are households with residents aged between 41-64 (68%). This is very important information, also due to the consideration of the form and style of the recommendations being prepared. If they are to be personalized, it is necessary to consider who will be their recipient and how they should be developed in order to fulfil their role and reach the decision makers.



For classification to individual segments, the authors decided to take into account the first 8 most important questions indicated by the model, which were discussed here and resulted from empirical research. Moreover because of the results of literature analysis and after consultations with partners, two factors were also added to this set: income and whether the property is owned or rented. The distribution of responses regarding whether consumers own or rent a flat or property is presented below. Consumers who own property are dominant group among respondents. In the case of this group there are more possible energy-saving solutions to propose in the form of recommendations. This distinction is very important due to the application of the recommendation to the possibilities and needs of the recipient. People who rent real estate are not always the decision-makers in matters such as investment or the replacement of household appliances to a greener one. They also do not decide on energy saving methods such as investments in solar panels or house insulation. Recommending actions that people are not able to take or perform could make that consumers would badly rate the work with the eco-bot application and would be discouraged to use such tools in the future.



The reference to income in discussing consumer behaviour is important especially because they are tangible values that allow searching for interdependencies in the sphere of real phenomena and processes. The importance of income as a factor shaping consumer behaviour is perceived by many researchers, as manifested in referring to it in numerous theories of consumer behaviour. Each consumer having strictly defined financial resources must manage them in a way that ensures optimal satisfaction of his needs, which are limitless in relation to limited financial resources. Therefore, he must determine what and in what quantity he will acquire, and how he will distribute his income between individual consumer products and services. Deterioration of the income situation enforces changes in

the management of funds, and thus the change of the existing lifestyle. Similarly to those who rent real estate, people with low incomes will not invest in costly ways to save energy, even if they are profitable in the future. Therefore, the scope of the recommendation should also be adjusted to the recipient's financial capabilities.

8.4 Obtained results of research for commercial energy consumers

Due to the limiting approach to building a behavioural model for commercial clients (more extensive explanation in chapter 8.1), only the most important research results concerning this sector are presented here. The research results will be important when developing recommendations for this type of clients. The authors decided to build the model also in this case, but it will be based on different assumptions than the model for individual clients. First of all, it is needed to identify the factors that affect the reduction of energy consumption in companies.

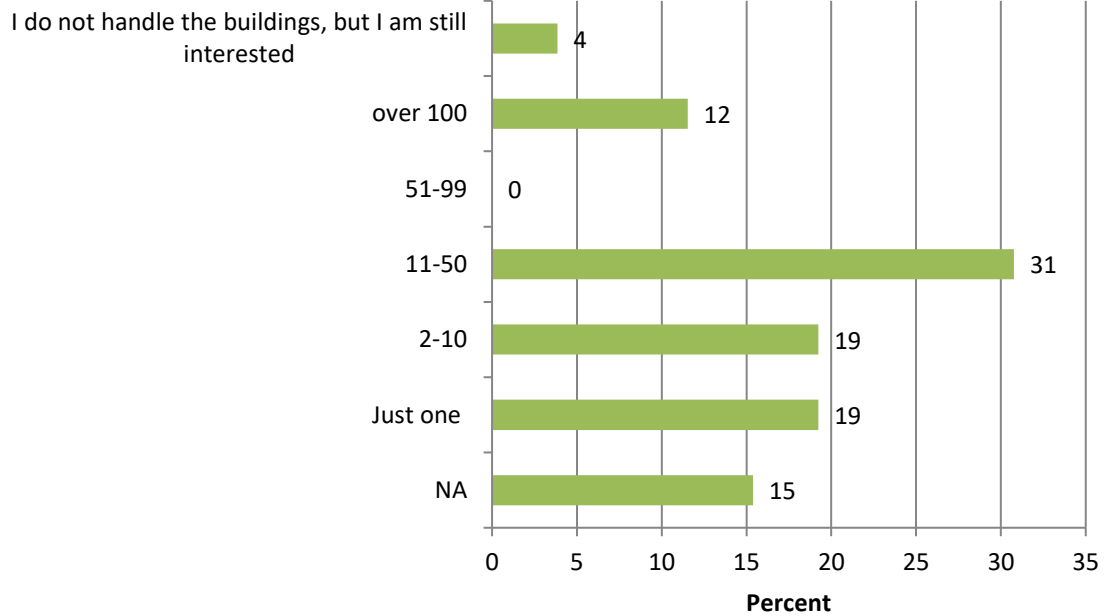
The main assumption of effective use of final energy in companies is to reduce its consumption with unchanged operating conditions. The basic tool used to search for energy savings are energy efficiency audits, during which a standard set of analyzes is carried out, aimed at:

- identification of places generating energy losses;
- determination of the actual level of energy losses in relation to possible lower levels based on available technical solutions
- presentation of possible tasks to minimize identified losses,
- execution of economic analyzes defining the payback period expenditures incurred.

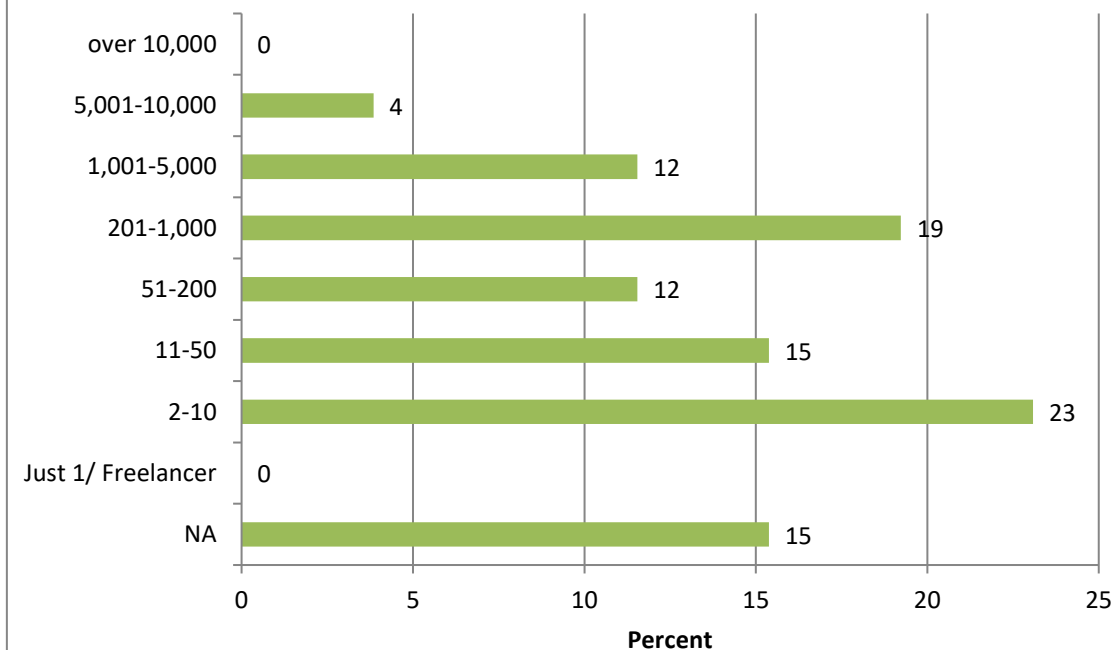
Energy management in the building is associated with monitoring energy consumption, technical condition of the building, its equipment and devices in it. In the case of the eco-bot project, it is also important to identify the number of buildings managed by the facility manager, what kind of company it is, where it is located and how many employees work there. As the research shows, the largest number of managed buildings is in Spain (65%), their managers work in Energy Services Company ESCO (54%) or other non energy-related companies (27%) and the main types of buildings managed are hotels, office buildings, supermarkets and restaurants.

The graphs below show the distribution of respondents' answers regarding the number of managed buildings and people working there.

Q2. How many buildings do you handle?



Q4. How many employees work in your company?



The graphs show that among managers the dominance is the management of the average number of buildings (range 11-50 31% of indications) or a smaller number (1-10 38% of responses). 12% of respondents manage over 100 buildings. There is also a small number of indications (4%) of the situation in which the person completing the survey is not currently managing any buildings, but is interested in managing in the future. Half of the respondents indicate that it manages buildings in which 2 to 200 employees work, while 35% indicate that the number of employees working in managed institutes is in the range from 200 to 10,000. Nobody has indicated more than 10,000 employees working in managed buildings.

Another important information helpful in developing recommendations is the answer to the question: How often and what kind of attempts to optimize electricity consumption in buildings you handle were undertaken in the past? The distribution of responses is presented in the table below.

Q6. How often and what kind of attempts to optimize electricity consumption in buildings you handle were undertaken in the past? (percentage of responses given)							
	Always	Often	Occasionally	Rarely	Never/ Not applicable	I do not know	NA
Turn off lights and appliances when not in use	35	15	19	4	0	4	23
Buy green energy from my utility provider	23	0	15	15	12	12	23
Use energy-efficient bulbs	42	19	12	0	0	4	23
Change settings on the thermostat (turning up air-conditioner in the summer and turning down thermostat in winter)	38	27	8	0	0	4	23
Consume less	38	23	12	0	0	4	23
Do not leave devices on stand-by	15	23	15	15	4	4	23
Change the heating / cooling system to a more efficient one	12	19	23	8	8	8	23
Change of the energy tariff to a more efficient one	23	23	15	4	4	8	23
Close windows before turning on or up the heating	23	23	23	4	0	4	23

Implement systems for monitoring energy behaviours of employees	19	27	12	8	4	8	23
Applying for a subsidy for the implementation of energy optimization solutions	12	23	15	15	4	8	23

As can be seen, most of the proposed solutions have been applied always or often in the surveyed companies (fields marked in green). Ways of rational use of energy are different - depending on the industry and the work performed. The most common activities are:

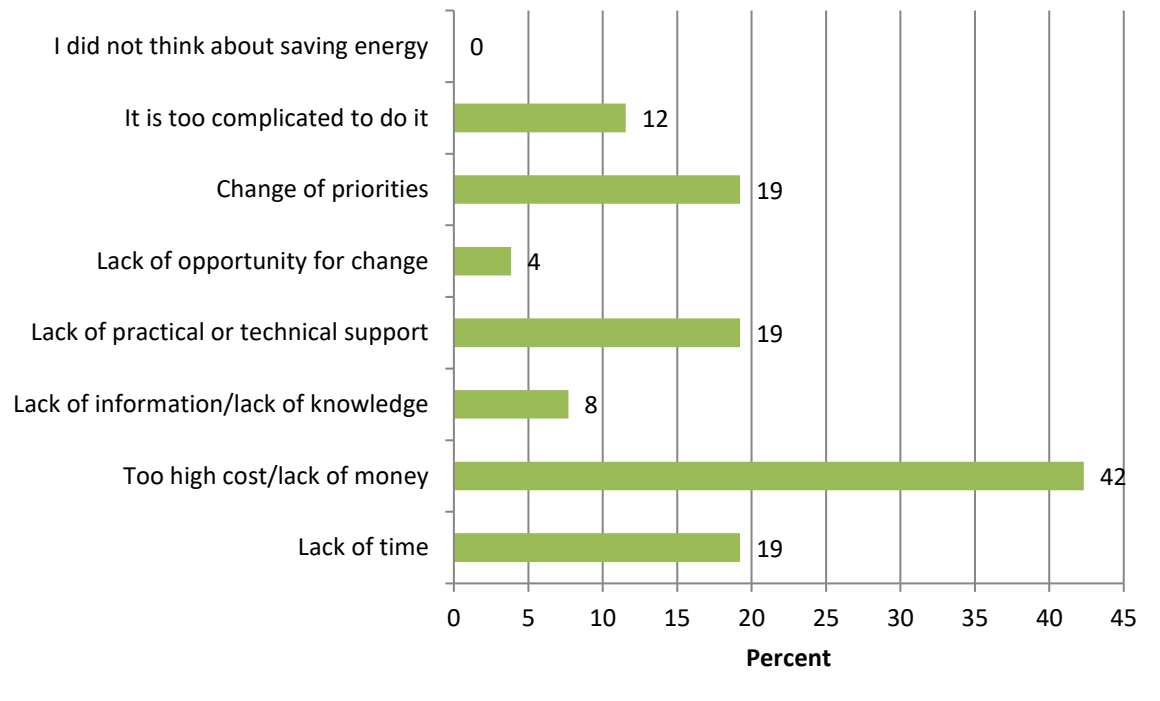
- turning off unnecessary lighting, devices which are not used;
- use of energy-saving light sources, devices, technologies, time-saving energy switches
- limiting the use of energy-powered devices.

Methods of saving energy that few respondents pointed to impossible to apply are mainly: buying green energy from utility provider or changing the heating / cooling system to a more efficient one (red in the table). It is also important that a small percentage of respondents indicated an answer: I do not know, which shows that managers have an awareness of pro-ecological activities taking place in the buildings they manage.

Non-investment methods require from the manager a lot of commitment and understanding of work organization and the specifics of the processes carried out in the enterprise. As part of non-investment activities, the work system in the company can be changed. You can also take a closer look at the technological processes and consider what operations can optimize these processes. It depends not so much on eliminating certain activities, but rather on putting them apart in time. The relatively cost-free method is, for example, increasing the control of power installations, monitoring and the operation time of devices, especially the most energy-intensive ones. Moreover quite inexpensive methods that can be introduced in the company also include monitoring of employees' behaviour, educating employees and indicating good practices of efficient energy use. First of all, simple methods should be recommended systematically.

The chart below shows the main reasons for not taking measures to optimize energy consumption in the company according to the respondents. This is also very important information, useful for further work on the eco-bot application. As in the case of individual consumers, the managers also indicate too high costs or lack of funds for such investments. The obstacle, however, is not the lack of opportunities for change or knowledge. Quite often, respondents indicated that they do not have enough time to carry out such changes, have different priorities or do not have technical or practical support.

**Q7. What were the reasons for not attempting to optimize electricity consumption?
(indicate as many answers as you like)**



The remaining answers to the questions asked in the questionnaire indicate that, the energy saving measures investments which could their organization easily afford in are mainly: replacement of equipment's for more efficient ones (Light bulbs with LED bulbs, new boilers, heat recovery etc) – 46% indications, and stopping stand-by consumptions and turning off lights when not in use – 42%. Respondents also mainly indicated that it takes between 1 month and 5 months the adaptation process of their companies after the introduction of new energy saving measures - 35% of indications, and also they expected that the undertaken investments will be returned within 1 to 5 years - 38%.

Taking into account the results of research and the specifics of the project partners, the authors decided to build a model for commercial consumers, initially based on the following factors: type of activity - the sector in which the company operates and the size of activity, measured by the number of people employed there. The authors will prepare a set of both behavioural and investment recommendations adapted to these factors. In addition, during the pilot phase of the project, the authors will monitor the functionality of the developed guidelines, and taking into account the additional information received from the persons participating in the pilotage, the model along with the guidelines will be refined to the existing needs.

9. Conclusions

This deliverable consists of two main parts. The first one aims to present the construction of research tool – the survey questionnaire (chapters 4 and 7). This tool will allow to gather necessary information in a form of a data set, required in the modelling stage. The important conclusions from this part can be listed as follows:

1. In order to prepare questionnaires for the eco-bot project, a large number of models using factors were analyzed. The multiplicity and variety of models and the much greater number of factors used in these models, their repetition and similarity were both easy and difficult to analyze. Over 500 factors were examined. Based on this analysis, the selection has been made and the most important factors have been chosen. Various difficulties occurred during the analysis, such as the presence of similar factors in different models. Based on the analysis integrated factors were selected. They were used to constructing questions in the survey.
2. The primary goal of conducting preliminary surveys was to test and to evaluate the constructed tool for its refinement and development for eco-bot project purposes. This goal was fully achieved, the preliminary survey fulfilled its task and its findings and experience achieved during conducting the survey was helpful in improving the main tool. The basic conclusion which results from the study is the necessity to resign from open questions and also to shorten the form significantly, which was done. Some of the questions have been reformulated so that the respondents would have no doubts when completing the questionnaire. During the building of the main tool, some of the test questions were abandoned due to their insufficient relevance to the research, but also the detailed questions necessary to carry out the customer segmentation were introduced. In addition, the opinions of surveyed respondents were also collected for comparative purposes. These results gave the researchers an initial view on the subject of energy consumption and also served as a basis for analyzing the constructed tool. In our opinion, after analyzing the results of preliminary tests and consultations with project partners, we managed to construct a universal tool, thanks to which the main goal of the research can be achieved. We believe that conducting preliminary research for business consumers was not necessary. In business consumer research, non-behavioural factors play a major role, while behavioural questions have been implemented from the individual consumer questionnaire. It did not therefore require additional preliminary studies.
3. Conducting research using online research tools has a number of advantages, but researcher should not forget about potential errors and threats resulting from the

use of this medium. Respondents' fears about data confidentiality, potential technical limitations or frequent abandonment of incomplete questionnaires are just some of the potential and discussed errors. The literature on the subject indicates some activities that the researcher can take to reduce the risk of errors and their impact on the quality of data obtained through an online survey. The literature research on good practices, the results and conclusions from the preliminary surveys and from the first main study as well as consultations with project partners allowed the preparation of a final research tools targeted at users from the household sector and commercial buildings sector. The questionnaire regarding the residential sector includes a number of questions regarding various aspects related to energy behaviours and the characteristics of the household itself. In the case of a questionnaire aimed at obtaining data from the commercial buildings sector, the questions relate to the features of the respondent and the organization he/she represents and his/her expectations concerning the use of modern solutions in energy management. Both surveys were prepared taking into account the recommendations resulting from the segmentation assumptions prepared in the D2.3 report. Moreover the second survey tool took into account the characteristics of modified eco-bot segmentations sectors tailored to the needs of the project, assumed after analyzing the first survey outcomes.

In the second part of this deliverable the detailed description of the research results is presented (chapter 5 and 8) and it can be summarized in the following way:

1. The first and second main surveys were conducted using a standardized CAWI method, the research sample was chosen in a targeted manner, in accordance with the assumptions of the non-random selection of the respondents' sample. Survey research concerned two basic groups of respondents: individual and commercial from Germany, Great Britain and Spain. The surveys were sent to all Dexma Sensors SL, Estabanell Y Pahisa Eneregia SA and Senercon's GMBH customers.
2. The obtained results from the first survey, based on the assumption of the segmentation from D2.3 were not sufficient to properly build the classification model. The respondents were mainly classified into two categories on the basis of responses: Green-advocate energy savers (GAES) and Traditionalist cost-focused energy savers (TCFES). To ensure correct operation of the model, the training set should contain all the options possibly existing in the examined reality. As the results of surveys of segmented questions show, the proposed segmentation does not fully reflect all foreseeable options of consumer beliefs and motivations. Hence after consultation with partners from adelphi it was decided to repeat the survey.
3. Analyzing different approaches to consumer segmentation, including sustainable consumers as well as analyzing factors influencing consumers' behaviour,

especially energy consumers, the authors have developed the suggested segmentation further based on the first empirical studies. The authors distinguish 5 segments: Ecological Idealist (EI); Aspiring Ecologist (AE); Dedicated Saver (DS); Opportunist (O) and Indifferent (I). The characteristics of new consumer segments for the eco-bot project were described in Chapter 6.

4. Second empirical survey verified the assumptions regarding segmentation, and its results can serve, on the one hand, to build the eco-bot behavioural model for individual energy consumers and, on the other hand, to create customer engagement strategies and to elaborate individual, tailored to the segment, recommendations.
5. While analyzing the results of the second research, the authors and their partners noticed the limitations and doubts related to the classification of commercial consumers. Therefore, it was decided that these types of customers would be divided according to other criteria that would be more appropriate for the specific and needs of the sector, such as the type of business, size of the institution and number of jobs, etc. At the same time, however, bearing in mind the objectives and assumptions of the project for this segment, recommendations regarding: investments related to the change or modification of significant enterprise components and behaviours related to the expected change in employee behaviour will also be prepared for this sector.
6. In addition, after this stage of research, it was decided to monitor the functioning of the model and the usefulness of the developed recommendations during the pilot phase. The authors decided that it would be necessary to verify the assumptions of the model and, consequently, improve it. Moreover it will be necessary to increase or decrease the number of recommendations after receiving additional information from users after the test period, so that the model will be more effective and fulfill the assumptions and objectives of the project .

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ANNEX A: Preliminary survey questionnaire

Dear Sir/Madam

As a part of eco-bot, Horizon 2020 research project funded by the European Commission, we would like to know your opinion about some key questions regarding the energy consumption.

Your comments and suggestions are very important and could help us to understand the consumers' point of view and improve our research tools.

Please note that participation is voluntary and the survey is anonymous. All your ideas and concepts are welcome. Thank you in advance for your contribution.

Preliminary information:

Gender:

Age:

Type of house (apartment/house) (owned/renting):

Number of people in the house:

Living with Family/flatmates/spouse/on your own:

I. Please read carefully and answer the following questions:

1. Do you know how you can optimize your electricity consumption?

- a) Yes
- b) No

2. Do you control your electricity consumptions?

- a) Yes
- b) No

If not what is/are the reason/s?

.....

3. What factors would most encourage you to plan your energy use and to start saving energy in your household?

.....

.....

4. Do you feel social pressure to control or to reduce your electricity consumptions?

- a) Yes
- b) No

5. Did you ever change your heating/cooling system?

- a) Yes, how many times, during last 5-15 years.....
- b) No

If yes, what was the reason to do so?

.....

6. Based on your opinion, what are the barriers of your engagement towards increasing energy savings?

.....
.....

7. What is the single most effective thing that you could do to use less energy in your life?

.....
.....

8. Which of the following statements you can most relate to? (Please indicate the most appropriate answer)

- a) I do not want to waste money so I watch my energy consumption.
- b) I am energy efficient so I watch my energy consumption.
- c) I want to take good care of my house so I watch my energy consumption.
- d) I am aware of climate change so I watch my energy consumption.
- e) I care about environment so I watch my energy consumption.
- f) I am satisfied with my level of energy consumption.

9. Would you be interested in adopting energy saving measures if they would require change of the behaviours in your household? (Please indicate the most appropriate answer):

- a) Yes, I would definitely do so to protect the environment
- b) Yes, but only if I would reduce my bills
- c) Yes, but only if it will improve the value of my home
- d) Yes, but only if they are easy to implement
- e) No, I am not interested in any changes of my behaviour

10. What kind of information/ tips from your energy provider regarding energy are the most important for you?

- a) Early notifications if my bill can be higher than normal
- b) General advice on actions I could take to lower my bill
- c) Notifications on the price of energy, especially if they are about to change
- d) Insights into factors that cause an increase in my bill
- e) A free in-home energy management system so I can better manage my energy costs
- f) A weekly summary of my energy usage
- g) I am not interested in any information related to my energy consumption

11. What motivates you the most to save energy?

.....
.....

12. In the past 12 months, how much time did you spend in total interacting with a representative of your electricity provider (e.g., over the phone, e-mail, in a store, in your home, etc.)?

.....
.....

13. Did you have any Web and/or mobile interactions with a representative of your energy provider?

- a) Yes
- b) No

If yes, do you believe your digital experience with your energy provider is more difficult than interacting with other types of providers (e.g., telecommunications, retailers, cable providers)?

- a) Yes
- b) No

14. Would you like to use a chat bot tool to help manage energy in your household?

- a) Yes
- b) No

If not, why:

.....

15. How often do you want to receive information about energy efficiency from the chat assistant?

- a) Daily
- b) Once a week
- c) Once a month
- d) Less than once a month
- e) Requested while needed

16. How do you appraise your economic situation?

- a) Very good
- b) Good
- c) Neither good or bad
- d) Bad
- e) Very bad
- f) no answer

17. What kind of information do you want to receive from a chat assistant regarding energy?

.....
.....

II. Now, please answer some questions regarding this questionnaire

1. Do you think that this questions are understandable?

- a) Yes
- b) No

If not, please point which question/part of the question is/are unclear:

.....
.....

2. Do you think that we should ask more open questions?

- a) Yes
- b) No, these questions are enough
- c) No, these questions are too many

3. Do you think, that we miss some answers in closed questions?

- a) Yes
- b) No

If yes, indicate what is missing and in which question:

.....

4. Based on your opinion, what is necessary to ask consumers regarding electricity savings and energy management programs for?

5. Based on your opinion, how many questions should be asked/will be enough in the questionnaire that it would not be boring for the respondent?

6. If you have any more suggestions/or concerns regarding this questionnaire feel free to write them here down:

Thank you for your time and commitment. Eco-bot team.

ANNEX B: Individual consumers survey questionnaire- first survey

Dear Participant,

The University of Katowice is a partner in the eco-bot, research project, funded by the European Commission. With this questionnaire we would like to collect your opinion about some key questions regarding energy consumption.

Your participation in this study will help us understand the behaviour and motives concerning energy consumption. The answers of this survey will contribute to the preparation of personalized and targeted energy saving tips of a chat bot that will promote the rational use of energy. Full details of the project and the team can be found on our project website: www.eco-bot.eu

Your comments and suggestions are very important and will help us understand consumers point of view and improve our research tools.

Please note that participation is voluntary and the survey is anonymous. All your ideas and concepts are welcome. Thank you in advance for your contribution.

I want to take part in the survey and agree to use my answers for research purposes in this project

- a) Yes
- b) No

Thank you for agreeing. Go to the next page and answer as accurately as possible.

1) Do you own or rent the place you are currently living at?

- a) Own
- b) Rent

2) How would you describe your household energy consumption and cost?

- a) It is very high
- b) It is high
- c) It is neither high or low
- d) It is low
- e) It is very low
- f) I do not know

3) How much thought do you give to saving energy in your home?

- a) A lot
- b) A fair amount

- c) Not very much
- d) None at all

4) Do you know how you can optimize your household energy consumption?

- a) Yes
- b) No

5) Were there any attempts to optimize energy consumption in your household?

- a) Yes [goes to the question 6]
- b) No [goes to the question 7]

6) How often and what kind of attempts to optimize electricity consumption in your household were undertaken in the past ?

	Always	Very often	Often	Occasionally	Rarely	Very rarely	Never / NA	I do not know
Turn off lights and appliances when not in use								
Buy green energy from my utility provider								
Use energy-efficient bulbs								

Change settings on the thermostat (turning up air-conditioner in the summer and turning down thermostat in winter)								
Consume less								
Do not leave devices on stand-by								
Changing the heating / cooling system to a more efficient one								
Change of the energy tariff to a more efficient one								
Close windows before turning on or up the heating								

Boil the kettle with just the amount of water you need								
Hang clothes out to dry rather than tumble drying								
Wash clothes at 30 degrees or lower								
Spend less time in the shower, and/or use less hot water for baths								

**7) What were the reasons for not attempting to optimize electricity consumption?
(indicate the three most important reasons)**

- a) Lack of time
- b) Cost/Money
- c) Scepticism (will it make a difference?)
- d) Lack of information
- e) Conflicting information
- f) Lack of adequate knowledge
- g) Other more pressing priorities
- h) Lack of practical or technical support
- i) Lack of support from family
- j) Scepticism from friends and/or neighbours
- k) Change of circumstance
- l) Change of priorities

- m) The belief that this will require considerable effort
- n) I did not think about saving energy
- o) I did not see any sense in it

8) Which of the following statements regarding energy use you can most relate to?

- a) I believe that I can contribute to the quality of the environment and it motivates me
- b) I want to save money on my energy bill and it motivates me
- c) I like improving my home for years to come, keeping it up-to-date
- d) I like convenient solutions that can be applied easily and will not require me to think about them
- e) I am satisfied and do not worry about my current energy use

9) For which of the following activities do you use your electric home appliances:

	Always	Very often	Often	Occasionally	Rarely	Very rarely	Never/NA
Heating							
Cooking							
Cooling							
Ventilation							
Laundry							
Cleaning							
Entertainment							
Workshop							
Office at home							

Gardening							
-----------	--	--	--	--	--	--	--

10) Please indicate the most appropriate answer.

	Very important	Important	Neither important nor unimportant	somewhat important	not important
How important are the environmental and climate change issues for you?					
How important is the economical management of money and budget that you have?					

11) Please indicate the most appropriate answer.

How strong is social (group) pressure to:	Very strong	Strong	Neither strong nor weak	Weak	Very weak	I don't care about social opinion
reducing energy consumption						
reducing bills						

using renewable energy sources						
reducing water consumption						
keeping my home and garden tidy						

12) Would you be most likely to adapt energy saving measures if they (Please indicate the most appropriate answer):

- a) significantly contributed to tackling climate change
- b) significantly reduced your energy bills
- c) significantly improved the value of your home
- d) were easy to implement and you would not have to think about them anymore
- e) None of the above, I am satisfied with my current energy usage

13) Would you be interested in adopting energy saving measures if they would require change of the behaviours in your household? (Please indicate the most appropriate answer):

- a) Yes, I would definitely do so to protect the environment
- b) Yes, but only if I would reduce my bills
- c) Yes, but only if it will improve the value of my home
- d) Yes, but only if they are easy to implement
- e) No, I am not interested in any changes of my behaviour

14) Would you be interested in adopting energy saving measures if they require you to make investments? (Please indicate the most appropriate answer):

- a) Yes, I would definitely do so to protect the environment
- b) Yes, but only if it would be a small sum
- c) Yes, but only if I would reduce my bills in the future
- d) Yes, but only if it will increase value of my house
- e) I am not interested in any investments

15) Please indicate how strongly you agree or disagree with each of the following statements

	Completely agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Completely disagree
I feel capable of reducing energy use in my home							
I think about saving energy because my friends save energy							
I think about saving energy because my family encourages me to do so							
Energy savings suits my lifestyle							
Energy savings is easy							
Energy saving is now fashionable							
I think about the environment, so I feel obliged to save energy							
I am concerned about global warming/climate change							
I believe that I need to change my lifestyle to address global warming and climate change.							
I am concerned about rising energy prices and fuel bills							
It is very important to me that part of my electricity supply comes from renewable sources							
I feel motivated to save energy if I can use public aid (eg							

preferential taxes, subsidies, loans)							
I think that saving energy requires specialist knowledge							
I do not think about saving energy at all							

16) Are you considering using any of the following ideas to save energy in the future and if so how probable/possible it is to implement for your household?

	Already done	Very possible	Somewhat possible	Not at all possible	I do not know
Turn off lights and appliances when not in use					
Drive less and use other forms of transportation					
Buy green energy from my utility provider					
Use energy-efficient bulbs					
Change settings on the thermostat (turning up air-conditioner in the summer and turning down thermostat in winter)					
Consume less					

Do not leave devices on stand-by					
Changing the heating / cooling system to a more efficient one					
Change of the energy tariff to a more efficient one					
Close windows before turning on or up the heating					
Boil the kettle with just the amount of water you need					
Hang clothes out to dry rather than tumble drying					
Wash clothes at 30 degrees or lower					
Spend less time in the shower, and/or use less hot water for baths					

Invest in renewable energy sources such as solar panels, geothermal energy or wind energy					
Use home insulation					
Purchase energy-efficient household appliances					

17. How is your attitude to using modern technologies? (Please indicate the most appropriate answer):

- a) I am an enthusiast, I always use them
- b) I like and use them in everyday life
- c) My attitude is indifferent I use them as far as I think it is useful
- d) I do not like but sometimes I am forced to use them
- e) I do not like and try not to use them

DEMOGRAPHICS

1. Number of people in the house:

- a) Age 0-18 [slider]
- b) Age 18-65 [slider]
- c) Age 65+ [slider]

2. How many people in the house work:

- a) Set hours e.g. 9-17 [slider]
- b) Different shifts [slider]
- c) From home [slider]

3. Is there a bedridden or disabled person within your household?

- a) Yes [slider]
- b) No

4. In which range can your household net income be found?

Spain:

- a) 2500 EUR/month and more
- b) Between 1000 EUR and 2500 EUR per month
- c) 1000 EUR/month and less
- d) No answer

Germany:

- a) 3600 EUR/month and more
- b) Between 2600 EUR and 3600EUR per month
- c) 2600 EUR/month and less
- d) No answer

5. What is your highest education qualification?

- a) No education
- b) Primary education
- c) Secondary education
- d) Post-secondary/tertiary education
- e) Bachelor or equivalent
- f) Master or equivalent
- g) Doctoral or equivalent
- h) Other

6. What is your current employment status?

- a) Full-time employment [goes to the question 7]
- b) Part-time employment [goes to the question 7]
- c) Unemployed
- d) Self-employed
- e) Homemaker
- f) Student
- g) Retired

7. Which type of job do you have now?

- a) Professional and technical (for example: doctor, teacher, engineer, artist, accountant)
- b) Higher administrator (for example: banker, executive in big business, high government official, union official)
- c) Clerical (for example: secretary, clerk, office manager, civil servant, bookkeeper)
- d) Sales (for example: sales manager, shop owner, shop assistant, insurance agent, buyer)
- e) Service (for example: restaurant owner, police officer, waiter, barber, caretaker)
- f) Skilled worker (for example: foreman, motor mechanic, printer, tool and die maker, electrician)
- g) Semi-skilled worker (for example: bus driver, tannery worker, carpenter, sheet metal worker, baker)
- h) Unskilled worker (for example: labourer, porter)
- i) Farm (for example: farmer, farm labourer, tractor driver)
- j) Other

Thank you for your time and commitment. Eco-bot team.

ANNEX C: Commercial users survey questionnaire - first survey

Dear Participant,

The University of Katowice is a partner in the eco-bot research project, funded by the European Commission. With this questionnaire we would like to collect your opinion about some key questions regarding energy management and energy efficiency.

Your participation in this study will help us understand the behaviour and motives of facility managers concerning energy consumption and energy efficiency investments in managed buildings. The answers of this survey will contribute to the preparation of personalized and targeted energy saving tips of a chat bot that will promote the rational use of energy. Full details of the project and the team can be found on our project website: www.eco-bot.eu

Your comments and suggestions are very important and could help us to understand the point of view of energy managers and improve our research tools.

Please note that participation is voluntary and survey is anonymous. All your ideas and concepts are welcome. Thank you in advance for your contribution.

I want to take part in the survey and agree to use my answers for research purposes in this project

- a) Yes
- b) No

Thank you for agreeing. Go to the next page and answer as accurately as possible.

1. In which country do you handle your buildings?

- a) Spain
- b) Germany
- c) United Kingdom

If it should consider more EU countries list will be included [EU countries listed]

2. How many buildings do you handle?

- a) Just one
- b) 2-10
- c) 11-50
- d) 51-99
- e) over 100
- f) I do not handle the buildings, but I am still interested

3. What kind of company are you working for?

- a) ESCO (Energy Services Company)
- b) Utility (Energy Producer/Distributor)
- c) OEM/ Hardware vendor
- d) Not an Energy-Related Company

4. How many employees work in your company?

- a) Just 1/ Freelancer
- b) 2-10
- c) 11-50
- d) 51-200
- e) 200-1.000
- f) 1.000-5.000
- g) 5.000-10.000
- h) over 10.000

5. Which type of buildings do you handle?

- a) Education facility
- b) Factory
- c) Health centre
- d) Hospital
- e) Hotel
- f) Housing
- g) Industrial warehouse
- h) Leisure facility
- i) Library
- j) Museum
- k) Office building
- l) Parking
- m) Restaurant
- n) Retail store
- o) Small office
- p) Sports facility
- q) Supermarket
- r) University

6. Were there any attempts to optimize energy consumption in buildings you handle?

- a) Yes [goes to the question 7]
- b) No [goes to the question 8]

7. How often and what kind of attempts to optimize electricity consumption in buildings you handle were undertaken in the past ?

	Always	Very often	Often	Occasionally	Rarely	Very rarely	Never / NA	I do not know
Turn off lights and appliances when not in use								
Buy green energy from my utility provider								
Use energy-efficient bulbs								
Change settings on the thermostat (turning up air-conditioner in the summer and turning down thermostat in winter)								
Consume less								
Do not leave devices on stand-by								
Changing the heating / cooling system to a more efficient one								
Change of the energy tariff to a more efficient one								
Close windows before turning on or up the								

heating								
Implement systems for monitoring energy behaviours of employees								
Applying for a subsidy for the implementation of energy optimization solutions								

8. What were the reasons for not attempting to optimize electricity consumption? (indicate the three most important reasons)

- a) Lack of time
- b) Cost/Money
- c) Scepticism (will it make a difference?)
- d) Lack of information
- e) Conflicting information
- f) Lack of adequate knowledge
- g) Other more pressing priorities
- h) Lack of practical or technical support
- i) Change of circumstance
- j) Change of priorities
- k) The belief that this will require considerable effort

9. Which of the following energy saving measures could your organization easily afford an investment in?

- a) Replacement of equipment's for more efficient ones (Light bulbs with LED bulbs, new boilers, heat recovery etc)
- b) Apply Free Cooling
- c) Stop stand-by consumptions and turn off lights when not in use
- d) Focus consumption on off-peak hour
- e) Retrofit the building envelope
- f) All of the above
- g) None of the above

10. Would you be interested in adopting energy saving measures if they would require change of the behaviours in your organizations? (Please indicate the most appropriate answer):

- a) Yes, I would definitely do so to protect the environment
- b) Yes, but only if it would reduce my bills
- c) Yes, but only if it will improve the value of my buildings
- d) Yes, but only if they are easy to implement
- e) No, I am not interested in any changes

11. How long does it take to adopt a scope energy saving measure in one of the buildings that you handle?

- a) Less than one week
- b) Between one and four weeks
- c) Between one month and 5 months
- d) More than 6 months
- e) Don't know

12. What is the expected time of return on energy efficiency investments in your organization ?

- a) Less than six months
- b) Between six and twelve months
- c) Between one year and five years
- d) Between five years and ten years
- e) More than ten years
- f) Time of return is not important
- g) Don't know

13. How is your attitude to using modern technologies? (Please indicate the most appropriate answer):

- a) I am an enthusiast, I always use them
- b) I like and use them in everyday life
- c) My attitude is indifferent I use them as far as I think it is useful
- d) I do not like but sometimes I am forced to use them
- e) I do not like and try not to use them

14. Would you like to use a chat bot tool to help manage energy in buildings you handle?

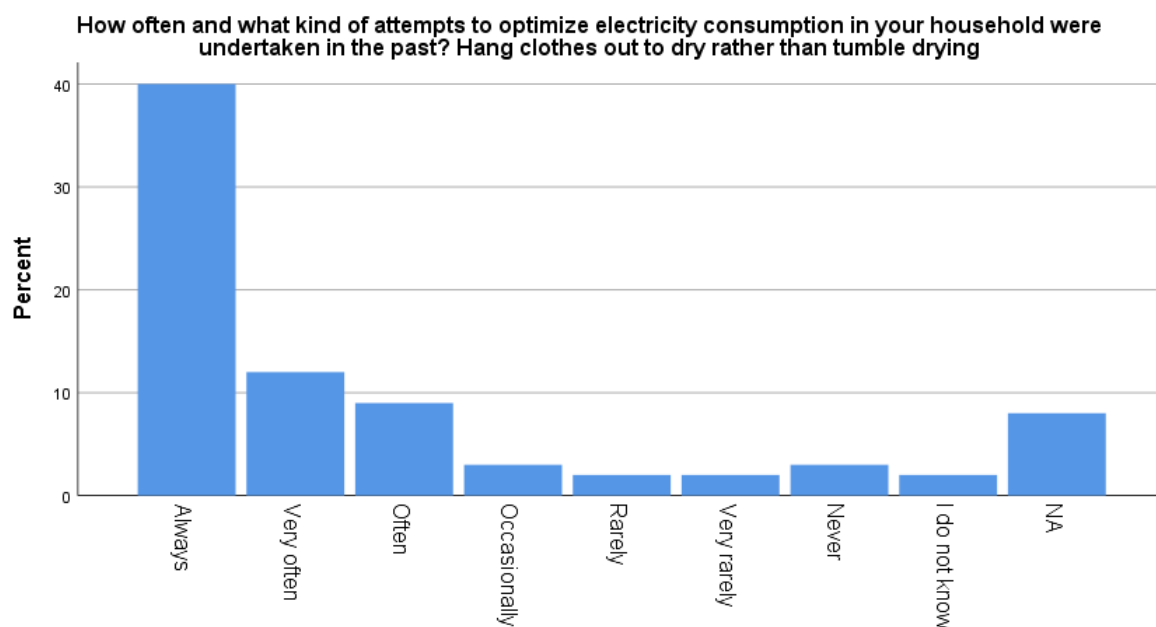
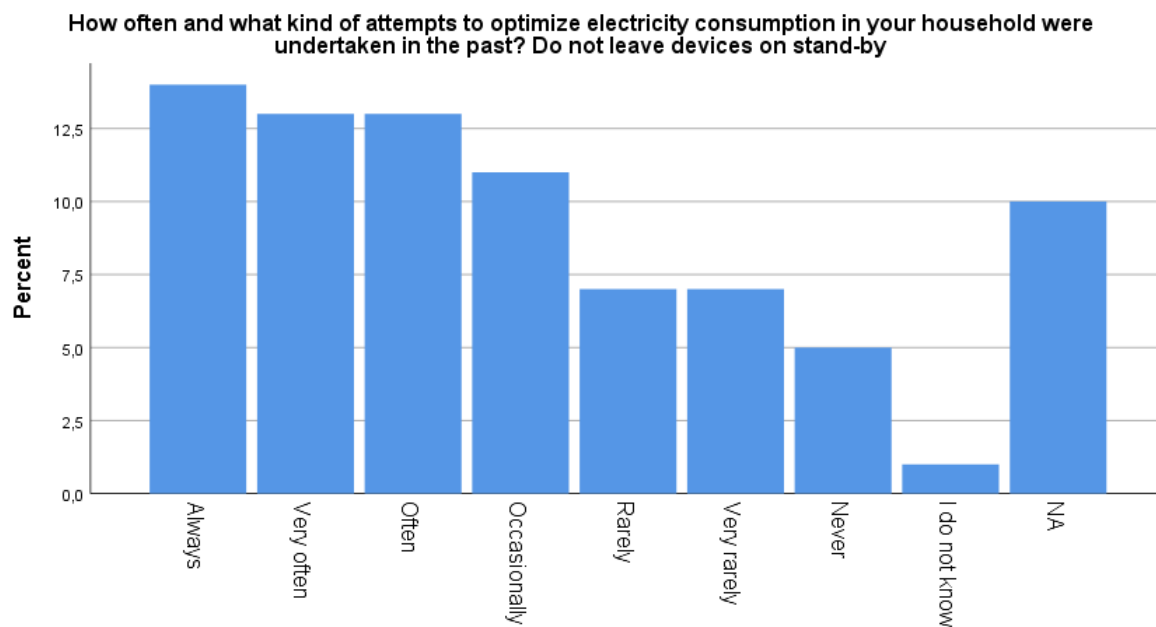
- a) Yes
- b) No

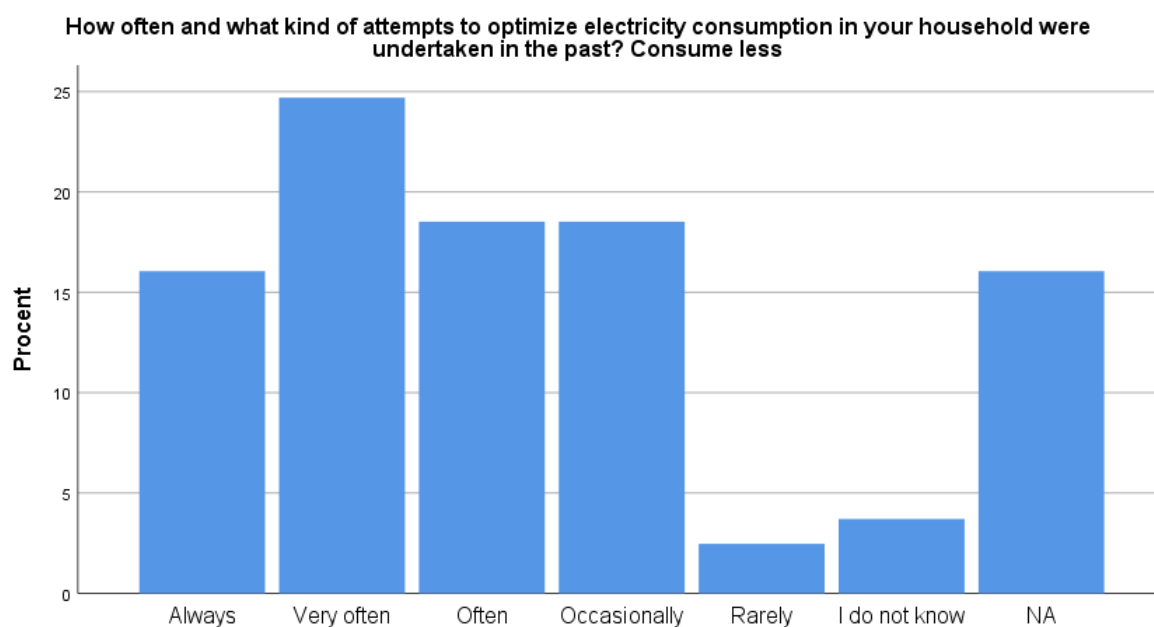
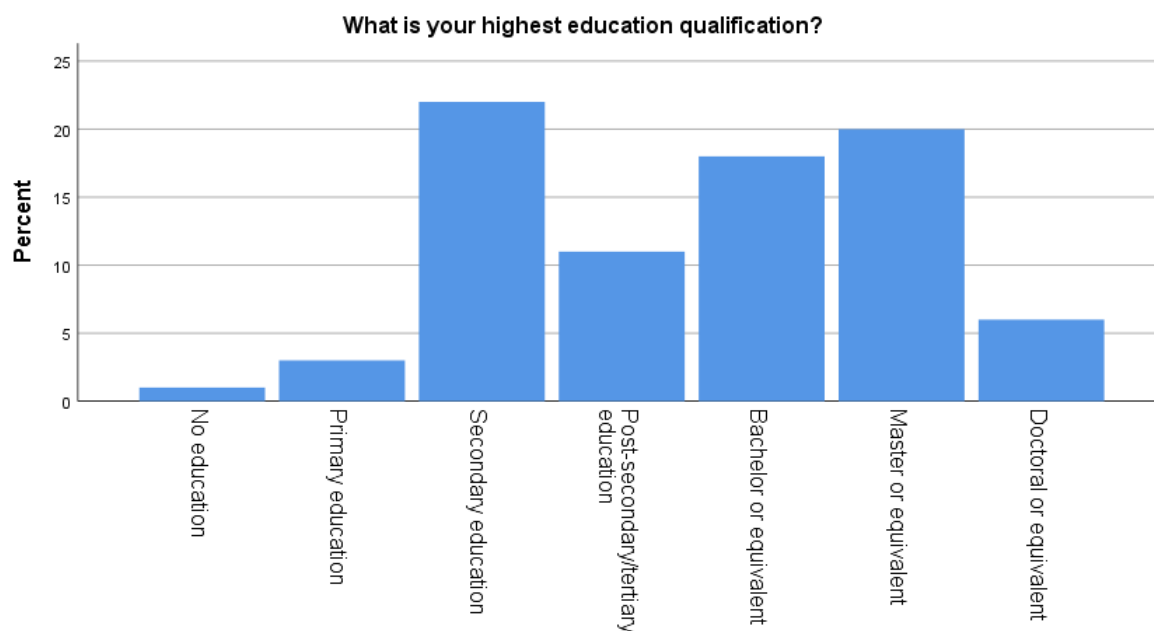
15. How often do you want to receive information about energy efficiency in the buildings you handle?

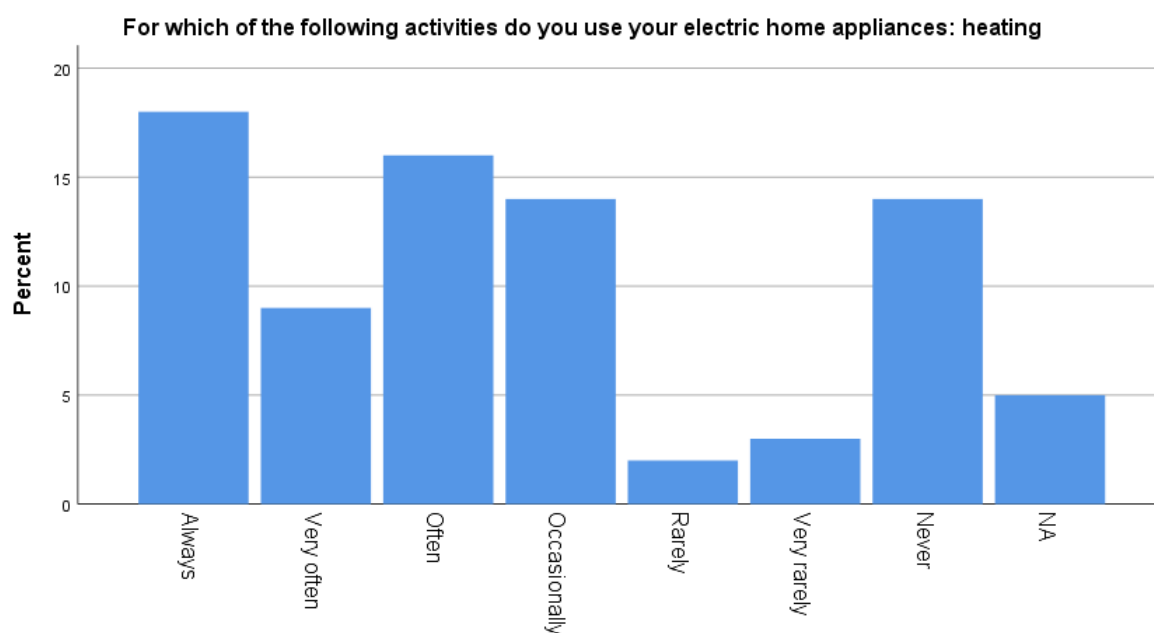
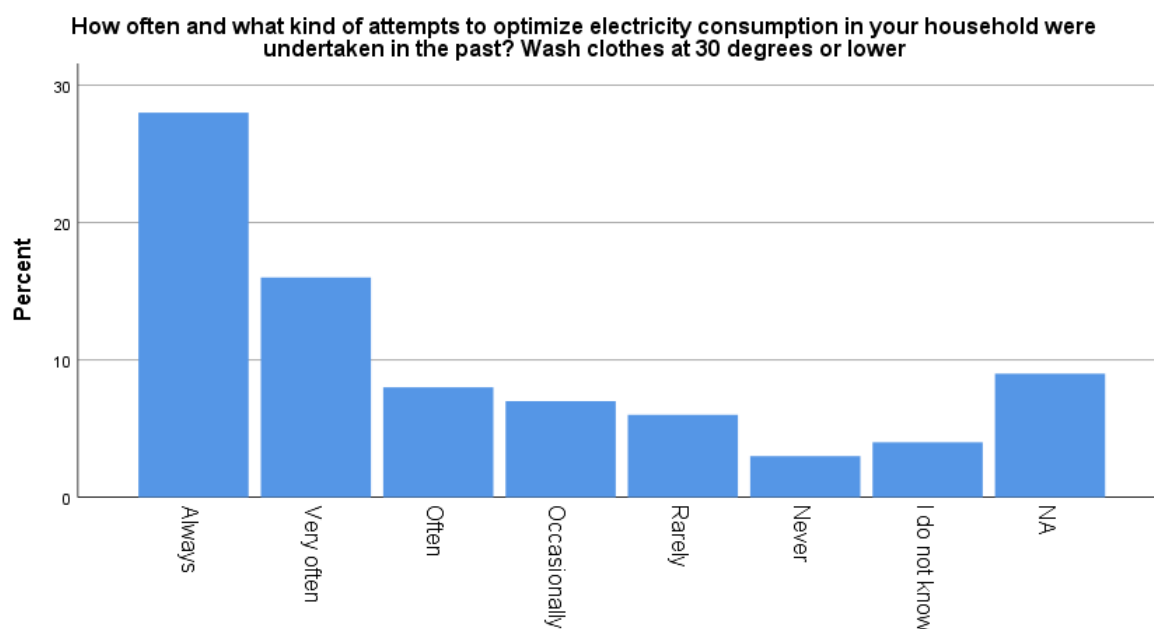
- a) Daily
- b) Once a week
- c) Once a month
- d) Less than once a month
- e) Requested while needed

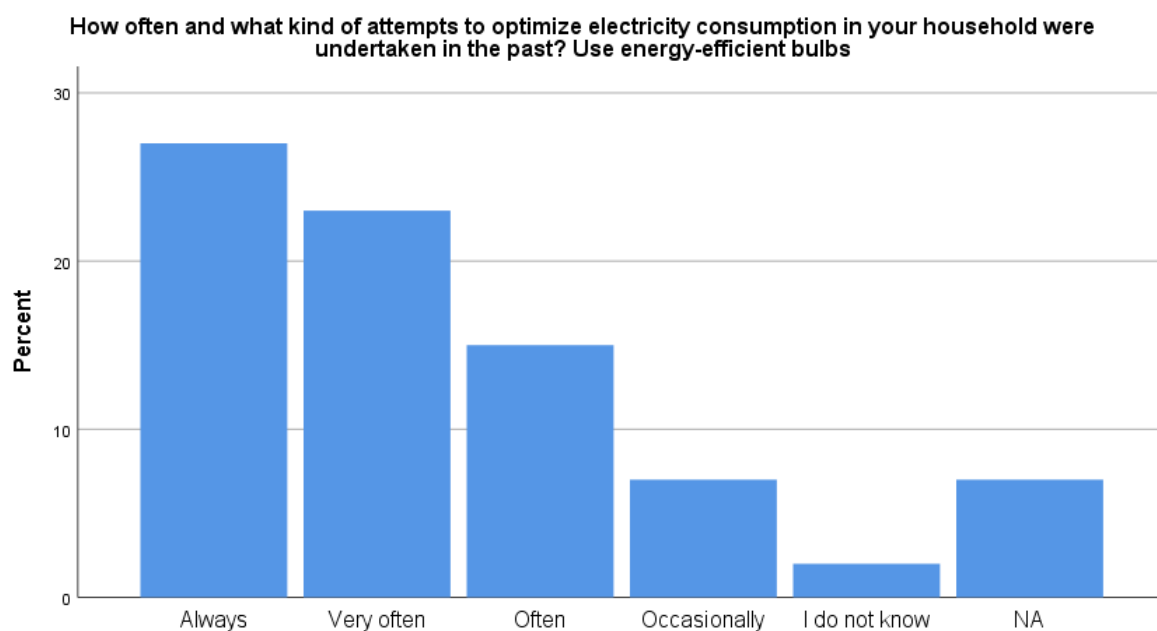
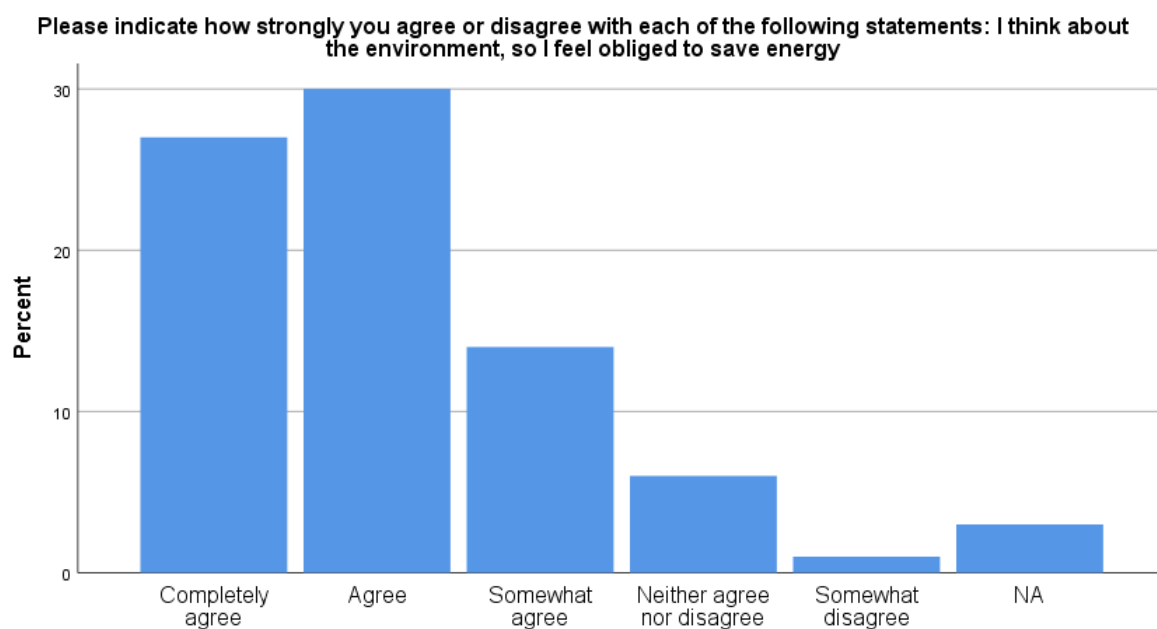
Thank you for your time and commitment. Eco-bot team.

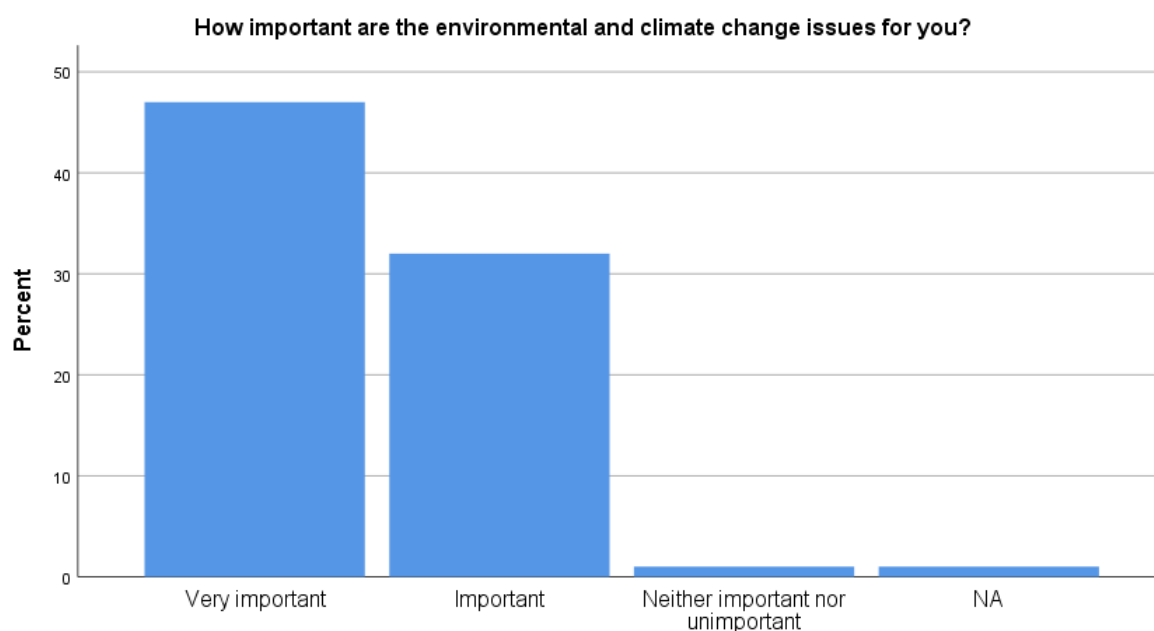
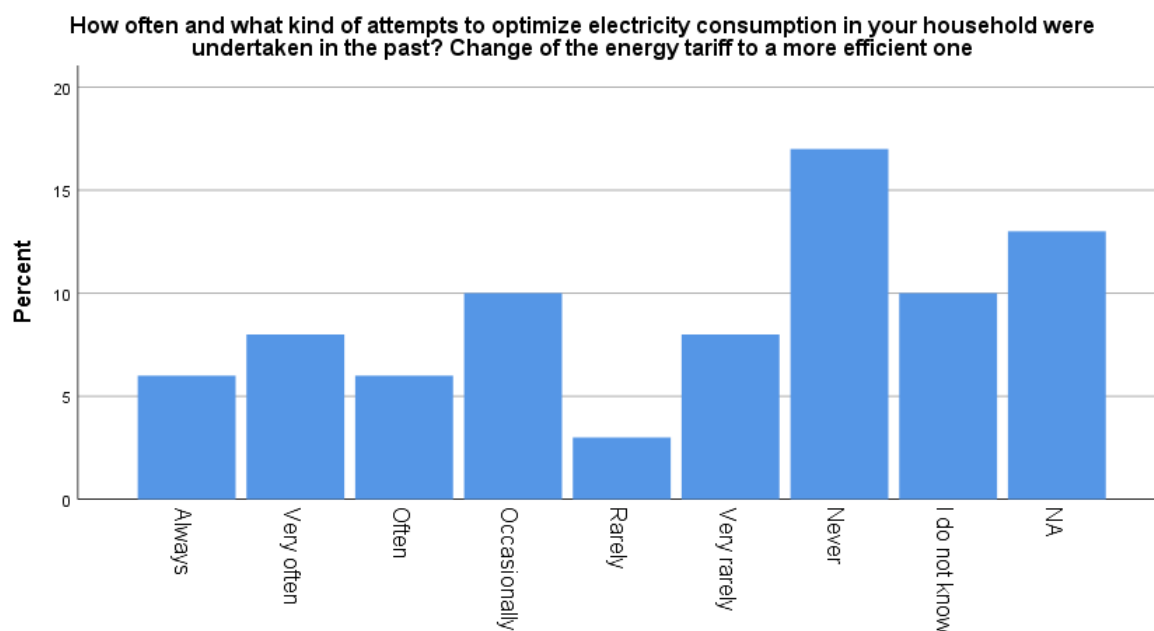
ANNEX D: Hierarchy of questions sensitive to the model - respondents' answers from the first survey











ANNEX E: Individual consumers survey questionnaire- second survey

Dear Participant,

The University of Katowice is a partner in the eco-bot, research project, funded by the European Commission. With this questionnaire we would like to collect your opinion about some key questions regarding energy consumption.

Your participation in this study will help us understand the behaviour and motives concerning energy consumption. The answers of this survey will contribute to the preparation of personalized and targeted energy saving tips of a chat bot that will promote the rational use of energy. Full details of the project and the team can be found on our project website: www.eco-bot.eu

Your comments and suggestions are very important and will help us understand consumers point of view and improve our research tools.

Please note that participation is voluntary and the survey is anonymous. All your ideas and concepts are welcome. Thank you in advance for your contribution.

I want to take part in the survey and agree to use my answers for research purposes in this project

- a) Yes
- b) No

Thank you for agreeing. Go to the next page and answer as accurately as possible.

1) Do you own or rent the place you are currently living at?

- a) Own
- b) Rent

2) How often and what kind of attempts to optimize electricity consumption in your household were undertaken in the past ?

	Always	Often	Occasionally	Rarely	Never/ Not applicable	I do not know

Turn off lights and appliances when not in use						
Switch to green electricity in order to reduce CO2-emissions						
Use energy-efficient bulbs						
Reduce the heating temperature when leave the house in winter or increase the temperature on the air conditioner when leave the house in summer						
Reduce the use of home appliances						
Do not leave devices on stand-by						
Chang the heating / cooling system to a more efficient one						
Use home appliances mainly during off-peak hours						

Close windows before turning on or up the heating						
Boil the kettle with just the amount of water you need						
Prefer line drying than tumble drying						
Wash clothes at 30 degrees or lower or use the eco mode setting						
Save warm water when taking a shower or bath						
Purchase energy-efficient household appliances						

3) Which of the following statements regarding energy use you can most relate to?

- a) I think about the environment, so I feel obliged to save energy
- b) I want to save money on my energy bill and it motivates me
- c) Green is new black and I want to help the planet
- d) I like convenient solutions that can be easily applied
- e) I am satisfied and do not worry about my current energy use

4) For which of the following activities do you use your electric home appliances:

	Always	Often	Occasionally	Rarely	Never/ Not Applicable
Heating					
Cooking					
Cooling					
Air conditioning					
Laundry & Cleaning					
Entertainment					
Home office					
Gardening					

5) Which of the following statements about energy saving applies to you:

- a) I save energy because my social group tells me how (or tells me to)
- b) I am well informed and feel positively motivated, thus I save
- c) I do not know how but I would like to save energy
- d) I save energy because I know it will reduce my bills
- e) I do not really thought about how to save energy

6) Would you be interested in adopting energy saving measures if they would require change of behavior of people living in your household?:

- a) Yes, but only if it will improve the value of my home
- b) Yes, but only if they are easy to implement
- c) Yes, but only if I would reduce my bills
- d) No, I am not interested in any behavioural changes
- e) Yes, I would definitely do so to protect the environment

7) What were the reasons for not attempting to optimize electricity consumption? (indicate as many answers as you like):

- a) Lack of time

- b) Too high cost/lack of money
- c) Lack of information/lack of knowledge
- d) Lack of practical or technical support
- e) Lack of opportunity for change
- f) Change of priorities
- g) It is too complicated to do it
- h) I did not think about saving energy

8) Do you feel social pressure to save energy/be more energy efficient/reduce bills?

- a) I don't care about social pressure
- b) Yes, very strong social pressure
- c) Yes, but only moderate social pressure
- d) Yes, but only weak social pressure
- e) No, I do not feel any social pressure

9) If I think about saving the energy, than:

- a) I want to use electricity from renewable sources
- b) I feel that energy savings suits my lifestyle
- c) I do not feel like I need to change anything
- d) I am concerned about rising energy bills
- e) I would like to use public aid

10) Are you considering to use any of the following ideas to reduce your energy consumption or your CO2 emission in the future and if so how probable/possible it is to implement them for your household?

	Already done	Very possible in the nearest future	Not possible in the nearest future	I do not know	Never/ Not Applicable
Turn off lights and appliances when not in use					
Switch to green electricity in order to reduce CO2-emissions					
Use energy-efficient bulbs					

Reduce the heating temperature when leave the house in winter or increase the temperature on the air conditioner when leave the house in summer					
Reduce the use of home appliances					
Do not leave devices on stand-by					
Change the heating / cooling system to a more efficient one					
Use home appliances mainly during off-peak hours					
Close windows before turning on or up the heating					
Boil the kettle with just the amount of water you need					
Prefer line drying than tumble drying					
Wash clothes at 30 degrees or lower					
Save warm water when taking a shower or bath					
Invest in renewable energy sources such as solar panels, geothermal energy or wind energy					
Use home insulation					

Purchase energy-efficient household appliances					
--	--	--	--	--	--

11) Would you be interested in adopting energy saving measures if they require you to make investments?

- a) Yes, at any cost because money barely matters to me if it comes down to protect the environment
- b) Yes, but only if it would be a small sum
- c) Yes, but only if it pays off in a short time
- d) Yes, but only if it will increase value of my house
- e) I am not interested in any investments

DEMOGRAPHICS

Once more we want to reassure you that no indentifying information will be collected. All information provided is anonymous and could not be used to identify you. They will be collected for scientific purpose in order to improve the functioning of the Eco Bot application.

1. Number of people in the house: [fill]

2. What kind of people live in your household?

- a) 0-18
- b) 18-25
- c) 26-40
- d) 41-64
- e) 65+

3. In which range can your household net income be found?

Spain:

- a) 2500 EUR/month and more
- b) Between 1000 EUR and 2500 EUR per month
- c) 1000 EUR/month and less
- d) No answer

Germany:

- a) 3600 EUR/month and more
- b) Between 2600 EUR and 3600EUR per month
- c) 2600 EUR/month and less
- d) No answer

4. What is your highest education qualification?

- a) Primary education
- b) Secondary education
- c) Post-secondary/tertiary education
- d) Bachelor or equivalent
- e) Master or equivalent
- f) Doctoral or equivalent
- g) Other

5. What is your current employment status?

- a) Full-time employment
- b) Part-time employment
- c) Unemployed
- d) Self-employed
- e) Homemaker
- f) Student
- g) Retired

Thank you!

Thank you so much for your contribution. Results of this survey will improve the functioning of eco-bot application. We hope that it will provoke discussion about environment and energy saving and will be helpful for consumers in their future energy management

ANNEX F: Commercial users survey questionnaire - second survey

Dear Participant,

The University of Katowice is a partner in the eco-bot research project, funded by the European Commission. With this questionnaire we would like to collect your opinion about some key questions regarding energy management and energy efficiency.

Your participation in this study will help us understand the behaviour and motives of facility managers concerning energy consumption and energy efficiency investments in managed buildings. The answers of this survey will contribute to the preparation of personalized and targeted energy saving tips of a chat bot that will promote the rational use of energy. Full details of the project and the team can be found on our project website: www.eco-bot.eu

Your comments and suggestions are very important and could help us to understand the point of view of energy managers and improve our research tools.

Please note that participation is voluntary and survey is anonymous. All your ideas and concepts are welcome. Thank you in advance for your contribution.

I want to take part in the survey and agree to use my answers for research purposes in this project

- a) Yes
- b) No

Thank you for agreeing. Go to the next page and answer as accurately as possible.

1. In which country do you handle your buildings?

- a) Spain
- b) Germany
- c) United Kingdom
- d) Other

2. How many buildings do you handle?

- a) Just one
- b) 2-10
- c) 11-50
- d) 51-99
- e) over 100

f) I do not handle the buildings, but I am still interested

3. What kind of company are you working for?

- a. ESCO (Energy Services Company)
- b. Utility (Energy Producer/Distributor)
- c. OEM/ Hardware vendor
- d. Not an Energy-Related Company

4. How many employees work in your company?

- a) Just 1/ Freelancer
- b) 2-10
- c) 11-50
- d) 51-200
- e) 201-1.000
- f) 1.001-5.000
- g) 5.001-10.000
- h) over 10.000

5. Which type of buildings do you handle?

- a) Education facility
- b) Factory
- c) Health centre
- d) Hospital
- e) Hotel
- f) Housing
- g) Industrial warehouse
- h) Leisure facility
- i) Library
- j) Museum
- k) Office building
- l) Parking
- m) Restaurant
- n) Retail store
- o) Small office
- p) Sports facility
- q) Supermarket
- r) University
- s) I do not handle the buildings, but I am still interested

6. How often and what kind of attempts to optimize electricity consumption in buildings you handle were undertaken in the past?

	Always	Often	Occasionally	Rarely	Never/NA	I do not know
Turn off lights and appliances when not in use						
Buy green energy from my utility provider						
Use energy-efficient bulbs						
Change settings on the thermostat (turning up air-conditioner in the summer and turning down thermostat in winter)						
Consume less						
Do not leave devices on stand-by						
Changing the heating / cooling system to a more efficient one						
Change of the energy tariff to a more efficient one						
Close windows before turning on or up the heating						
Implement systems for monitoring energy behaviours of employees						
Applying for a subsidy for the implementation of energy optimization solutions						

7. What were the reasons for not attempting to optimize electricity consumption? (indicate as many answers as you like)

- a) Lack of time
- b) Too high cost/lack of money
- c) Lack of information/lack of knowledge
- d) Lack of practical or technical support
- e) Lack of opportunity for change
- f) Change of priorities

- g) It is too complicated to do it
- h) I did not think about saving energy

8. Which of the following statements regarding energy use you can most relate to?

- a) I think about the environment, so I feel obliged to save energy
- b) I want to save money on my energy bill and it motivates me
- c) Green is new black and I want to help the planet
- d) I like convenient solutions that can be easily applied
- e) I am satisfied and do not worry about my current energy use

9. Which of the following energy saving measures could your organization easily afford an investment in?

- a) Replacement of equipment's for more efficient ones (Light bulbs with LED bulbs, new boilers, heat recovery etc)
- b) Apply Free Cooling
- c) Stop stand-by consumptions and turn off lights when not in use
- d) Focus consumption on off-peak hour
- e) Retrofit the building envelope
- f) None of the above

10. Would you be interested in adopting energy saving measures if they would require change of the behaviours in your organizations?

- a) Yes, but only if it will improve the value of my buildings
- b) Yes, but only if they are easy to implement
- c) Yes, but only if it would reduce my bills
- d) No, I am not interested in any changes of my behaviour
- e) Yes, I would definitely do so to protect the environment

11. How long does it take to adopt a scope energy saving measure in one of the buildings that you handle?

- a) Less than one week
- b) Between one and four weeks
- c) Between one month and 5 months
- d) More than 6 months
- e) Don't know

12. Which of the following statements about energy saving applies to you:

- a) I save energy because my social group tells me how
- b) I am well informed and feel positively motivated, thus I save
- c) I do not know how but I would like to save energy
- d) I save energy because I know it will reduce my bills
- e) I do not really thought about how to save energy

13. What is the expected time of return on energy efficiency investments in your organization?

- a) Less than six months
- b) Between six and twelve months
- c) Between one year and five years
- d) Between five years and ten years
- e) More than ten years
- f) Time of return is not important
- g) Don't know

14. If I think about saving the energy, than:

- a) I want to use electricity from renewable sources
- b) Energy savings suits my lifestyle
- c) It will not make any difference
- d) I am concerned about rising energy bills
- e) I would like to use public aid

Thank you!

Thank you so much for your contribution. Results of this survey will improve the functioning of eco-bot application. We hope that it will provoke discussion about environment and energy saving and will be helpful for consumers in their future energy management.