Deliverable 2.1
Definition of the Use Cases and Requirements

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D2.1: DEFINITION OF THE USE CASES AND REQUIREMENTS

Summary

This deliverable includes the final outcomes and conclusions of the workshop implemented under Task 2.1 with the main goal to define the use cases and eventually the requirements of the project, identify sources over which proven evidences will be created and the multiple factors affected energy behavior will be classified. This deliverable also describes activities that were done under Task 2.1 before and after the opening workshop that provided further feedback and built open the results from the workshop.

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CA: Consortium Agreement

CO: Confidential

DoW: Description of Work, referring to the Annex I of the Grant Agreement

EC: European Commission

GA: Grant Agreement

IPR: Intellectual Property Rights

PPR: Project Progress Reports

PSB: Project Steering Board

PU: Public

QA: Quality Assurance

SAB: Security Advisory Board

STC: Scientific and Technical Committee

WP: Work Package

Executive Summary

This is the first deliverable of the Eco-Bot project. It describes the outcomes of the opening workshop, organized at the start of the project (month 2) and it also describes activities performed before and after the opening workshop that enhanced the results and built upon them. The aim of the workshop was to bring out important issues that need to be taken into account in the following steps and to give the consortium a wider view of the project and its context in the different European countries where Eco-Bot will be applied. The opening workshop had 3 focuses: a consumer focus aimed at specifically talking about the needs of the users of Eco-Bot and how to address them, a policy focus were possible policies affecting Eco-Bot were discussed, and a wider focus of "opinions from experts and stakeholders" where various additional points were discussed and presented. The workshop also included interviews with consumers aimed at giving input to upcoming tasks. The workshop also provided space for meetings between the consortium members were certain internal project points were discussed and clarified. The results of the opening workshop were then used to start a more detailed Eco-Bot requirement definition.

1. Introduction

The Eco-Bot tool aims to become a personalized "virtual energy advisor" chat-bot, which will function as a consultant to consumers, answering questions and giving them advice to help them reduce their energy consumption. The goal, target group, and approach of the eco-bot project are broadly described and illustrated in Figure 1.

Goal	• User engagement to raise awareness in behavior with regard to energy efficiency
Target group	• Residential and commercial energy consumers
How?	• Chatbot technology & non-intrusive load monitoring techniques
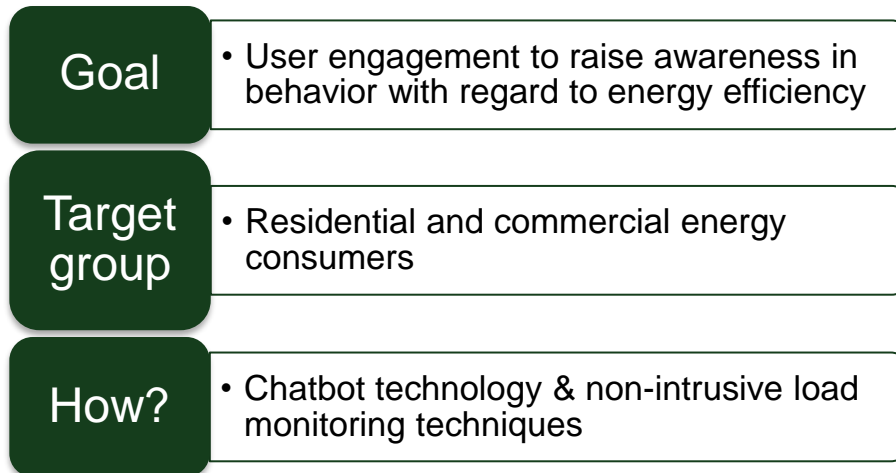
Figure 1: Goal, target group, and approach of eco-bot

Achieving the goal, however, is not straightforward as the relationship between human behavior and energy efficiency is complex, multi-factorial, and often suffers from the rebound effect, where consumers start to consume more when they know they are using energy efficient appliances. Hence understanding the target group and the users' needs is key to designing a chat-bot that will be engaging and useful.

Another point to address is legal issues or limitations that may affect the project. For the chat-bot to give personalized information, it must have access to certain data about users and their consumption through the data available from smart meters.

Eco-bot should learn from previous experiences related to energy efficiency and customer engagement available in and out of the consortium, to identify key points to integrate or to avoid in the Eco-Bot concept.

Thus, before starting further development of the project and the tool, the consortium should be aware of all these issues to integrate them early on in the work to follow. For this reason the first task in the project is organizing an opening workshop. This opening workshop was open to external key participants, where these issues were addressed and use cases, requirements, and important factors were identified. This one-day workshop was further

complemented with other activities (described in detail in the following sections) to better finalize the results of Task 2.1 and give input to Task 2.3.

2. Task and Workshop Objectives and Definition

The workshop objective is to influence and help define upcoming work in the project, generally outlining key themes to consider, prioritizing issues, situations, and challenges. Through the workshop and further activities, the task objective is to define the use cases and begin the discussion and elaboration of the user requirements for each use case.

2.1. Definition of the opening workshop

The workshop objectives were met through the following:

- Involving key participants from the private and public sector
- Addressing big questions and contemporary topics in relation to Eco-Bot
- Discussion on the use cases and requirements between workshop participants defining a first approach and listing of the requirements
- Discussion of solutions similar to Eco-Bot
- Discussion and definition of next steps

The sessions in the workshop had to be designed and defined such that they help identify and prioritize issues, situations, and challenges to be resolved. Thus, it was decided during the kick-off that the three categories of topics, seen in Figure 2, and invited participants would be included, while still leaving space and time for further discussions that may come up.

Figure 2: Main topics and speaker categories in the opening workshop

Key participants were invited either as panel guests or as workshop attendees that can pose questions and participate in the discussions with the consortium members and the panel. The workshop was defined such that it would address the three topics, starting from the opinion and point of view of a key participant as a panel guest, and afterwards a discussion would follow with attendees. This allowed the workshop to be dynamic, and outcome driven.

2.2. Activities prior and in continuation of the opening workshop

To better meet the objectives several activities were performed prior and after the workshop.

Prior to the workshop it was decided to:

- Perform an analysis of solutions similar to Eco-Bot in different European countries, to identify highlights and interesting features, these would be used to feed the discussion in the workshop and incorporate aspects from tools in different European countries
- Incorporate in the workshop points from the discussions and work with the MSc Select students and the Swedish consultancy Sweco related to Eco-Bot (elaborated on in section 3.3)

Given that a more mature definition of the use cases and a comprehensive list of user requirements is an exercise that requires time and reiterations, it was decided that further activities and exercises would be done after the workshop to complement the workshop results and build on them. The activities performed are listed here and described in more detail in sections 5.1, **Error! Reference source not found.**, and 5.2:

- A preliminary survey with a set of facility managers that are clients of Dexma, to better prioritize the Eco-Bot user requirements for the facility manager user case.
- Based on the use cases discussed and the preliminary features outlined in the opening workshop, every pilot performed the "user stories" and "jobs to be done" exercise to define a more comprehensive list of requirements (elaborated in section 5.1)
- A workshop took place in the plenary meeting in Athens on May 3rd to perform an initial prioritization and classification of the user requirements of all the use cases

3.1.   Opening Workshop Setup

The workshop took place at Estabanell Energia's (EYEPSA) premises in Granollers, 40 minutes from Barcelona on December 4rth 2017. The workshop was setup in 3 main parts that can be seen in Figure 3. In the morning session external key participants joined the workshop and discussed the main topics outlined earlier. During lunch, the partner from University of Economics in Katowice (KAT) met with and interviewed 3 residential utility customers. In the afternoon key discussions were conducted between the consortium members on several specific topics related to the project, taking advantage of everyone's presence.
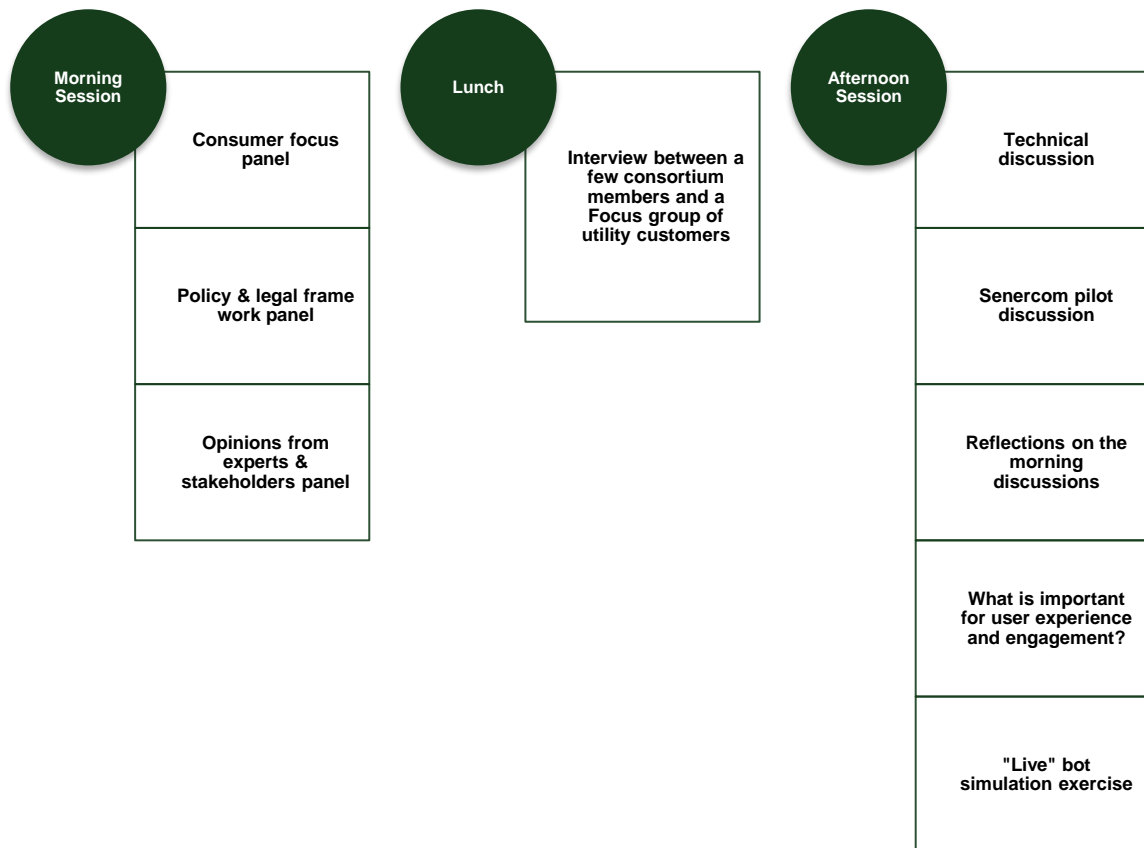
Figure 3: Opening workshop setup

3.2. Opening Workshop Participants

The workshop had participation from the consortium partners, as well as external key participants. The external participants can be seen in Table 1 and

Table 2, the consortium participation can be seen in Table 3. Photos of the workshop can be seen in Figure 4 and Figure 5. In total there were 23 participants in the workshop. The channels used to reach the guests consisted of the following:

- Contacts of Consortium members
- Clients of Dexma
- Guests recruited in the Jornada Connect-EU 2017 organized by Acció in Barcelona where Dexma and Estabanell presented the Eco-Bot project

In the selection of participants the aim was to have a speaker related to Eco-Bot's end users (Santi Martinez in the case of residential clients, and Xavier Espi in the case of commercial clients), a speaker that can speak on a general legal level both European and Spanish (Francesc Vidal), and a Speaker that has hands on experience with several energy efficiency projects (Carme Melcion, who combines this with experience in the public sector).

Table 1: Panel guests in the opening workshop

Guest	Organization	Position	Description
Xavier Espi	Sud (http://www.sud.es/en/home)	Salesperson	Dexma partner, that will monitor 10 supermarkets (Bon Preu) in Catalonia, where it is planned to use Eco-Bot.
Santi Martinez	Estabanell Energia	CEO	Partner that has participated in previous projects related to energy efficiency and customer engagement in the same pilot area of Eco-Bot.
Carme Melcion	Diputació de Barcelona	Technic OTCCS- Management of environmental services Area of territory	Working in energy efficiency projects involving several end user types

		and sustainability	
Francesc Vidal	Catalan Energy Institute (ICAEN) Generalitat de Catalunya	Head of Renewable Energies and International Unit	Promotion of renewable energy in Catalonia: energy advising, dissemination activities, regulatory proposals, etc. management of international projects

Table 2: Additional highlighted guests in the opening workshop

Guest	Organization	Position
Jordi Poch	Estabanell Distribució	ICT Director
Daniel Utges Mampel	Dexma	Product owner
Rocío Villalobos	Estabanell Energia	Commercial management
Yawei Wang	UPC	Masters student

Table 3: Opening workshop participants from the project consortium

Project partner	Number of attendees
Risa	1
Estabanell Energia	4
Dexma	3
Senercon	1
Plegma	1
Adelphi	1
Strath	2
KAT	2
Botego	0
Total consortium attendance	15

Figure 4: Eco-Bot opening workshop start

Figure 5: Eco-Bot opening workshop panel session

3.3. Activities prior to the opening workshop

Apart from the day of the workshop additional activities were performed prior to the workshop and served as material and discussion for the workshop itself. These activities are described below and fed into different sessions, most notably the two sessions "Consumer Focus" and "What is important for user engagement and experience?"

- Discussions and input from the select master students project on Eco-Bot managed by Estabanell and the Swedish consultancy Sweco (http://www.sweco.se/):

Estabanell collaborates with the InnoEnergy Masters Program MSc SELECT (http://www.innoenergy.com/education/master-school/our-master-programmes/msc-select-environomical-pathways-for-sustainable-energy-system/), where with input and coordination from the Swedish consultancy Sweco, it gives a team of students a real project to develop on their own, as a year long exercise. Throughout the project development the students receive guidance from Sweco, Estabanell Energia, and other parties collaborating with the program from all over Europe.

Estabanell gave the students the case of Eco-Bot to develop and present their own analysis and solution. The students presented the first part of their project the end of November (November 29th, 2017). Their approach proved to be quite interesting, and so it was also used as a point for discussion in the Opening Workshop itself.

The team developing the project consists of 8 students from different countries in and outside Europe, and their two advisors from Sweco in Sweden. The list of the participants in this project and its development can be seen in Table 4. The incorporation of aspects from their project allowed a wider European and fresh perspective on how Eco-Bot can be imagined, used, and commercialized.

Table 4: Participants in the Eco-Bot project for MSc Select

Participant	Organization
Aleksandra Radwanska	Universitat Politècnica de Catalunya
Paulina Krukowska	Universitat Politècnica de Catalunya
Vasco Mergulhao	Universitat Politècnica de Catalunya
Felix Sippel	Universitat Politècnica de Catalunya
Chloé Coral	KTH
Luca De Rosa	KTH
Valentina Herrera	KTH
Nina Hegazy	KTH
Magnus Linden	Sweco
Rachel Walsh	Sweco

Figure 6 below shows a photo of the discussion with the team prior to the workshop. Their project is now finalized, and the article on their work can be found on the eco-bot website.

Figure 6: Discussion with MSc Select students

- Analysis of solutions similar to Eco-Bot:

Prior to the workshop, bots that offer advice or services related to energy were researched, and highlights of some interesting solutions were brought into the discussion in the workshop. The bots discussed are implemented in the UK, Poland, and Spain and are presented in more detail in section 4.3.

3.4. Activities in continuation of the opening workshop

The opening workshop defined important topics and points for the project, as well as a first approach and preliminary listing of user requirements. However defining user requirements is not a task that can be done in one day, it needs several iterations, and is a task that will need to be constantly reviewed and further developed and refined over the duration of the project.

According to the DSDM Agile Framework (DSDM: Dynamic Systems Development Method), it is recommended to capture requirements at a high level in an early stage of the project, and only gradually detailing these requirements as the project progresses. The complete details of the requirements are developed as late as possible, assuring that evolving needs during the lifetime of the project have been captured, and that the team was able to develop the requirements with more time and a deeper understanding of the business and user needs (Agile Business Consortium Limited, 2014).

The DSDM Agile Framework was used as the framework for formulating the eco-bot user requirements. This was done in the following steps:

- Layout of the use cases in the opening workshop
- Definition of a preliminary list of features/user requirements in the opening workshop
- User stories and Jobs to be done exercise performed by every pilot after the workshop
- Comprehensive list of user requirements for every pilot is presented in the Athens workshop on May 3rd where the user requirements were prioritized in the "user requirements workshop".

The user stories and jobs to be done exercise and user requirement workshop in Athens are discussed in more detail in sections 5.1, **Error! Reference source not found.**, and 5.2.

4. Opening Workshop Outcomes

4.1. Consumer focus

The Eco-Bot tool will have two main user types:

- Facility managers (with a focus on supermarkets through Dexma's agreement with Sud and Bon Preu, as well as on hotels and restaurants)
- Residential customers

4.1.1. General key issues

During the workshop the discussions resulted in some key issues relating to end users, both as residential customers and facility managers.

The following key questions were identified (influenced by the MSc select group work):

- What is the motivation for using eco-bot?
- What is Eco-Bot's value proposition?
- How can Eco-Bot gain the trust of a customer?
- How can Eco-Bot acquire a customer?
- How can Eco-Bot retain a customer?

These questions were brainstormed between all participants, and the result can be seen in Table 5.

Table 5: Key success factors for Eco-Bot

Motivation	Value proposition	Trust
- Save money - Be more "green" - Social awareness (if Eco-Bot offers a social value) - Being control of	- Objective advisor - Fast - Personalized - Speaks the local language - Simple	- Follows data privacy regulations - Public support - Successful first conversation

- "home" or a specific building - Safety in the home - Tech interest - Competition with neighbours using the app (if feature is offered by Eco-Bot)	- No cost - Time savings - Always available - Proactive - Meter connected	- Friends are using the app
Acquire	**Maintain**	
- Strong motivation - Strong value proposition - How the dialogue starts - Curiosity - Peer pressure - Information campaigns - Endorsement from "cool" users - Invite a friend	- Social/shareable - Testimonials - Fun (game-like) - Incorporates external events - Effectiveness - Reward system - Gives value and clearly quantifies savings and progress - Not annoying to the user. - Presence of an "Eco-Bot" community	

4.1.2. Facility managers for commercial buildings

A discussion on the needs of facility managers (focusing on supermarket facility managers) and the potential for energy efficiency in commercial buildings resulted in a list of features that could be of key significance, and an important motivation for using Eco-Bot. These needs and the features they can result in can be seen in Table 6.

Table 6: Needs of facility managers, and eco-bot's possible approach

Facility manager activity/need	Description	Possible eco-bot value proposed
Weekly metrics	Facility managers spend a significant amount of time collecting weekly metrics on the energy and water consumption of their buildings. Examples of these metrics are: - kWh/m^2 - Comparison of present measurements with those of the same days, but the previous year	Eco-Bot can ask the facility manager about the metrics that are needed and when, and can with the data it collects calculate and communicate these metrics to the facility manager when they are needed
Recommendations on reduction of energy	Facility managers collect and analyze the needed data, they need to come up with methodologies to	Eco-Bot can automatically provide recommendations through a comparison of

consumption	improve the efficiency of certain processes	the specific situation with a portfolio of previous similar situations, collected in a database, for which a certain action proved to be successful.
Scheduling appointments with providers and other professionals	The facility managers spend a large amount of time finding and contacting specialized third parties to purchase new products or to meet for consulting them on specific issues	Eco-Bot could help in this process, by directly suggesting some specialized companies when needed, with their contact details, and could help the facility manager schedule an appointment with the needed partner
Thermal comfort advisor	An issue that is often faced in certain facilities, particularly supermarkets, is how to most efficiently maintain thermal comfort	Eco-Bot could offer suggestions related to efficiently achieving thermal comfort, and could give meaningful data by enhancing the system with installed thermostats
Prioritization of actions	There are several actions that facility managers can and need to do to address certain energy efficiency problems in their buildings, and they often need to prioritize	Eco-Bot can help the facility manager identify the high impact actions that address a problem, providing the relative magnitude of energy savings, economic savings, and payback time of different options
Protocol for tracking of an energy efficiency project	Facility managers need to keep track of different actions undertaken and identify the effects a certain action taken has had	Eco-bot can identify changes in consumption that happened after a certain action was taken, and can provide information on the energy and economic savings achieved to date
Comparison with similar buildings (benchmarking)	Facility managers can be in need of a reference to know how well their building is performing	Eco-bot can show the building standing in terms of energy consumption, in comparison to other buildings of similar types and size
Alarms	Facility managers try to encourage the mitigation of inefficient behavior	Eco-bot can notify when the consumption of a certain appliance has increased for a significant amount of

		time.
Energy cost advisor	The facility manager may not always be aware of price fluctuations on the market	Advise the facility manager on large peaks or drops of energy prices
Prioritization of Buildings	For facility managers that manage a lot of buildings on their portfolio and want to maximize energy savings	Eco-bot can identify high consumption or high impact buildings that can help direct the focus of the facility manager
News-feed	Facility managers need to maintain a holistic view of their facilities	The chat-bot can provide occasional news about overall performance

Additional aspects that can be made part of Eco-Bot and that can offer additional benefits to the facility manager can be seen in Table 7.

Table 7: Additional eco-bot benefits to the facility manager

Additional benefits	Description
Time saving value	Eco-bot should be able to make the tasks of the facility manager much faster, by partially performing them itself. This will allow the facility manager time to dedicate to other tasks or additional buildings
General + personalized advice	Eco-bot should have the ability to provide general and qualitative advice, as well as personalized and more quantitative advice
Multi-platform	The facility manager should be able to access eco-bot in several ways on the computer and on the smart-phone
Advanced content messages	Eco-bot should send and receive advanced content messages such as photos and graphs, and interpret them, making communication faster and clearer

4.1.3. Residential customers

Residential customers are a more difficult market segment to reach, as unlike the facility manager they are not specialized and working in energy related issues. This means that they may not directly see the benefit or importance of energy efficiency, and have diverse profiles making them more difficult to engage.

4.1.3.1. Insight from the BeeData Project

The BeeData project is a project that Estabanell Energia is participating in, in collaboration with CIMNE, the International Center for Numerical Models in Engineering based in UPC (Universitat Politecnica de Catalunya), which started in 06/2017. The project consists of the

creation and delivery of "smart bills" aimed at residential customers, bills that contain information, graphs, and advice that are useful to the consumer and easy to understand. Santi Martinez shared the Estabanell Energia's experience with the BeeData project during the opening workshop.

A sample of the BeeData bills can be seen in ANNEX A.

The experience from the BeeData project is valuable as it raises key questions that Eco-Bot will also have to face, and already provides some answers. The most important of these questions can be seen in Figure 7.
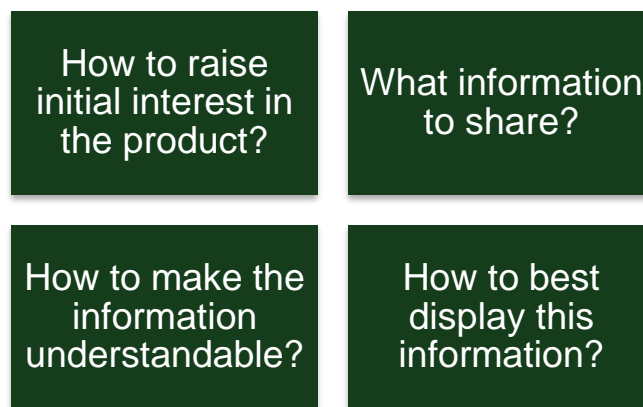
Figure 7: Key questions raised by the BeeData project.

How to raise initial interest in the project?

Before users use the Eco-Bot tool there is a simple previous step; the users have to be convinced to start using the tool. And the BeeData project sheds light on how important it is to attractively present Eco-Bot. Santi Martinez discussed the difficulties faced trying to recruit people to participate in the BeeData project (where they basically receive a free more detailed and upgraded bill, with no effort on their side).

To recruit participants in the project, emails were sent to 860 customers in the town of Tona, of which only 27 replied and joined the project in June 2016. Since then it has been maintained possible to join the project at Estabanell Energia's customer service office in the town, and the number of participants has grown to 80.

The first 27 people that agreed to join the project where overwhelmingly "techies", people that worked as engineers or technicians that already had some curiosity or interest in the project topic. After the project started, and these initial subscribers received the BeeData

bills, more people signed up due to recommendations from the participants, and information given by the customer service personnel in the Tona office.

Thus, an important task that should not be overlooked is how to raise interest in residential customers? How to present eco-bot in such a way that the average residential customer will be motivated to use it?

What information to share?

The BeeData bills share the following with residential customers:

- Periodically inform users on their consumption behaviour
- Give users recommendations on the best tariff for them in function of their personal consumption behaviour
- Give users advice on the contracted power that best fits their consumption
- Raise general awareness on energy issues
- Propose ways to reduce consumption
- Inform customers on their "energy efficiency standing"
- Provide comparisons of efficiency with similar households

Eco-bot can take these points and build on them, as in the case of BeeData a paper bill is received every month by customers, while Eco-Bot is continuously available and interactive.

How to make the information understandable?

The BeeData bills try to make the information as easy as possible to understand by the average residential customer. To achieve that it provides:

- Comparisons of consumption over time
- Comparisons of consumption with similar households
- Converts kWh into more "understandable" units
- Links consumption to weather data/time of year

How to best display this information?

The BeeData bills also try to transmit all the content as clearly as possible through:

- Visually attractive graphs and figures
- Colorful and friendly formatting
- Clearly defined sections with defined messages

These bills also need to be specially taken into consideration in the pilot in Tona, Catalonia, as a third of the residential customers participating the project have been receiving these bills, and will be expecting something more from Eco-Bot.

4.1.3.2. Diversity of consumption patterns

A last important point raised by the experience from the BeeData project, is that it is not accurate to assume that most people have a similar consumption pattern. This means that it is not useful to provide advice based on one pattern. Within the 3000 connected customers of Tona, 12 consumption patterns were identified, through analyzing their yearly consumption with several iterations. Eco-Bot should also aim to find these consumption patterns and classify users accordingly to give the highest quality and relevant advice possible.

4.1.3.3. Possible features and measures for residential customers

Possible features that came up in the discussion that could be part of the offering of Eco-Bot are listed in Table 8.

Table 8: Possible features of interest for residential customers

Possible feature	Description
General advice	General and qualitative advice regarding actions that could improve the efficiency of households (e.g. changing old electric appliances with more efficient ones)
Personalized advice	This can be both qualitative and quantitative, based on monitoring and analyzing of the consumption of smart meter data of a specific household (e.g. if you reduce your building temperature by 1°C you can save X% on your electricity bill)
Identification of inefficient appliances	Eco-Bot through disaggregation of smart meter data for appliance level consumption data, and communication with the end user, identifies inefficient appliances
Providing a list of providers/professionals and directing to other parties	Once an inefficient appliance is identified, Eco-Bot can recommend its substitution or maintenance and present a list of possible appliance providers or professionals (with their contact details) that can help eliminate the inefficiency
Advice and recommendations for on-site energy production	Recommendations for PV systems that may be of benefit to the user as well as to possible system providers
Information on funding	Some users might be unaware that they are eligible for a certain kind of funding relating to energy efficiency or onsite generation/storage, Eco-Bot can thus inform about funding opportunities related to energy at the home level

Feedback on implemented actions	Once the user implements an action recommended by Eco-Bot, changes in consumption are tracked and the results are communicated to the user in terms of energy and/or economic savings, keeping the user engaged
Forwarding to a real person	In certain cases, if the user asks for certain information that can be only addressed by a real person such as the customer service personnel of the user's energy provider, Eco-Bot can forward and connect the user with the right party
Push notifications / daily recommendations	Users can set alarms for particularly energy intensive days, can order a daily report (as well as one for the previous day), can get forward-looking recommendations based on the weather report.
Target establishment	Eco-Bot can allow the user to put energetic/economic targets (e.g. how much money to spend on energy per month) and help them reach the target utilizing concepts from gamification
Advanced content messages	The user can send images through the chat to make communication faster. For example, sending a photo of the label with specifications of a refrigerator, can allow Eco-Bot to identify the quality/age of the appliance and its level of efficiency
Online payments	The possibility that payments are made through Eco-Bots for appliance with certain providers, or electricity bills to the energy provider
Detailed data on high consumption days	Eco-Bot can provide users with more detailed analysis and data on days where consumption was especially high
Provide comparisons	Eco-Bot can provide comparisons between similar users regarding consumption levels and efficiency, to help users better understand where they stand, and to also encourage positive competition towards energy efficiency

4.1.4. Measures for improving customer interactions

To make Eco-Bot's interaction with the user more personalized and targeted, several measures were discussed that can be used to better define the kind of relationship most adequate for a certain end user. These measures can be seen in Table 9.

Table 9: Measures for improving the interaction with the customer

Measure	Description	Target	Goal
Energy understanding level	Asking questions initially to identify the user's understanding of energy related topics and vocabulary (e.g. does the user understand what is a kWh?)	Residential customer	Customer identification
Social situation	Define the customer's social situation (e.g. family with children or student apartment)	Residential customer	Customer identification
Time stamp + information collection	Collect information regarding customer actions (social and technological) over time	Residential customer + Facility manager	Customer identification
Frequency definition	Allow the user to define how frequently he/she would like to receive notifications from Eco-Bot	Residential customer + Facility manager	Most comfortable relationship
Evolving bot	Eco-Bot can help the user become slowly more acquainted with energy efficiency and related issues, and as time goes on, the conversation and the recommendations can become more advanced	Residential customer	Growing relationship
Limit length of the conversation	Avoid lengthening the conversation so	Residential customer +	Maintaining relationship

	as not to lose the interest of the user, trying to give relevant information in the most concise and understandable way	Facility manager	
Limit repeated advice	Avoid that the customer receives similar or repetitive answers from the Eco-Bot	Residential customer + Facility manager	Maintaining relationship

4.2.   Policy and legal framework

To address policy and legal aspects that may affect Eco-Bot, Francesc Vidal and Carme Melción provided some insights from a European policy perspective in general and more specifically in the Spanish and Catalan context. Senercon and Dexma also contributed regarding the framework in Germany and the UK where they have experience and a significant number of clients.

4.2.1. Possible relationship with public bodies

Eco-Bot can be an interesting tool for public institutions and organizations promoting energy efficiency, especially for addressing the residential sector. Carme Melción, from Deputació de Barcelona talked about the difficulty that is faced by these bodies in reaching the end customer in comparison with programs related to industries, commercial entities, or municipalities. Thus, Eco-Bot for its dissemination and exploitation activities should try to find partnerships with municipalities or public programs to try and promote energy efficiency.

4.2.2. Limits on possible energy savings

It is important to keep promises realistic regarding economic savings due to energy efficiency, especially for residential customers. This is because often, as in Spain, a big part of the electricity bill is a fixed cost that is not affected by the actual monthly consumption, but is fixed, regulated costs to pay for the grid and overall energy system, and taxes.

4.2.3. Energy efficiency certificates for buildings

All European countries have an obligation to certify buildings energetically (issuing building energy efficiency certificates); this is currently mandatory for new buildings or when buildings are put up for rent.

The building certifications, as well as the building energy demand, are in some places made available online (as in the case of ICAEN in Catalonia, where this information is public and available online). This can be a possible source of information for Eco-Bot.

4.2.4. Retailer role in energy efficiency

Spanish regulation has endorsed the EU directive for the promotion of energy efficiency at a domestic level. And according to this norm, all retailers should motivate their customers to save 1.5% of electricity every year; otherwise retailers face a penalty from the government. Germany plans to incorporate this norm in the coming year.

Unfortunately, the current regulation in Spain has put this norm in effect without yet specifying what indicators can be used to check if the retailers have reached this requirement. Therefore, retailers in Spain are currently obliged to pay the penalty by default.

In any case the norm, as more European countries adopt it, can mean that retailers will become increasingly interested in a tool like Eco-Bot for their customers, and can thus be an interesting target for the deployment of the tool after it is developed.

4.2.5. Limitations on data collection

In different European countries there are currently different norms and different kinds of meters or smart meters implemented, that collect and send information at different levels of granularity and intervals. This should be considered from the start in the project, as it can affect the Eco-Bot features that can be implemented in different locations.

4.2.6. Personal data collection and confirmation

For Eco-Bot to offer a personalized and engaging experience, it needs to collect personal information about its users. Some of this information can be sensitive and not straightforward to obtain and confirm. Consideration on data collection and privacy should thus be done from early on.

4.3. Opinions from experts and stakeholders

4.3.1. Rewards for motivating customers

The importance of rewards for keeping customers motivated was also highlighted. Possible forms of these rewards are described in Table 10.

Table 10: Possible forms of rewards

Reward	Description
Economic	Highlight the economic savings achieved
Social impact	Link efficiency achieved with a social impact sponsored by Eco-Bot, such as contributions to energy poverty programs
Ecological impact	Linking the efficiency achieved to a "green" impact e.g. number of equivalent trees…
Points in a purchasing club	Collect points that give you discounts with partners of Eco-Bot, e.g. appliance stores

Points for virtual prizes	Allow users to collect points in a game like way and win virtual "prizes"

An example that was mentioned by Carme Melción was the energy efficiency program "*Passa la Energia*", that was successfully implemented by the municipality of Barcelona. The program adopted gamification techniques and solidarity values to engage users' interest. The energy saved by residential users was then "passed" to schools, hospitals, or to segments of the population suffering from energy poverty.

4.3.2. Important additional aspects

The importance of the following aspects was also highlighted, as they were identified as having a big influence on the usage and success of the app:

- Use of statics
- Visually inviting design and content
- Use of images and simple graphs
- Clearly identify a customer profile
- An initial need to guide the conversation, as a user might simply not know what to ask and what to expect

4.3.3. Existing energy chat-bots

As it might be useful for upcoming work in the project, some research was done into existing bots available that tackle energy issues in different European countries, several were outlined in Poland, the UK, and Spain. They are listed in Table 11 and were used in the discussion in the workshop.

Table 11: Existing bots

Company	Type	Location	Service	Highlights	Business model
Enea (Enea, -) http://enea.eve.ecreation.nl/	Energy Company	Poland	The users can get informed of everything related to energy by simply touching (clicking on) the subject they are interested in ("with ENEA", "offer with guaranteed price", "green package offer", "ecological advice", "in contact with nature"). (See Figure 8)	Convenient and interactive.	B2C

| HomeHero (Gilliland, 2017)

https://www.econsultancy.com/blog/69023-a-review-of-homehero-the-energy-switching-chatbot

https://twitter.com/yourhomehero?lang=es	Energy Switching Service Company	UK	It tells the customer how much they can save with a different plan by scanning the bill QR code. See Figure 9.	Reduce the energy bills.	B2C
			Possibility to connect through FB messenger.	No need to download or sign in.	
			"Balloon Hunt "game: Sending a photo of an appliance and it will tell you how many balloons of CO2 it produces.	More fun and interactive. Raises awareness about environmental impact.	
Sentimer (Sentimer, -)

http://sentimer.com/solutions-utilities.html | Platform Company | Spain | Easy interface. See Figure 10. | High-quality user's experience. | B2B |
| | | | It provides unique, tailored advice and product recommendations to the users based on their revealed needs and context. | | |
| | | | Leverage natural language processing (NLP) to understand and use the user's own language. See Figure 11. | | |
| | | | Artificial intelligence is used to turn every user interaction with the chat-bot into valuable learnings, with Sentimer machine learning algorithms. | Improve gradually the level of personalization of features and recommendations. The more you use, the better your product can be. | |
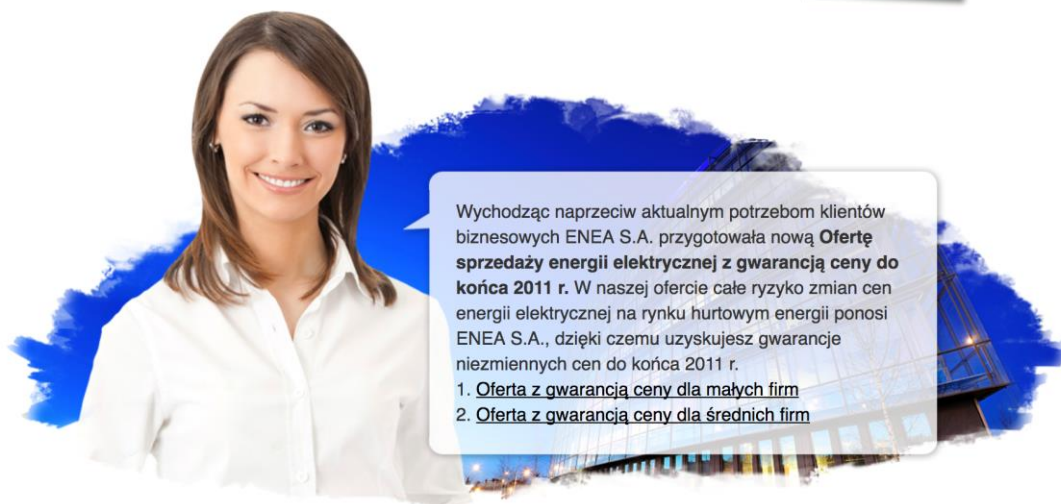
Figure 8: Enea website
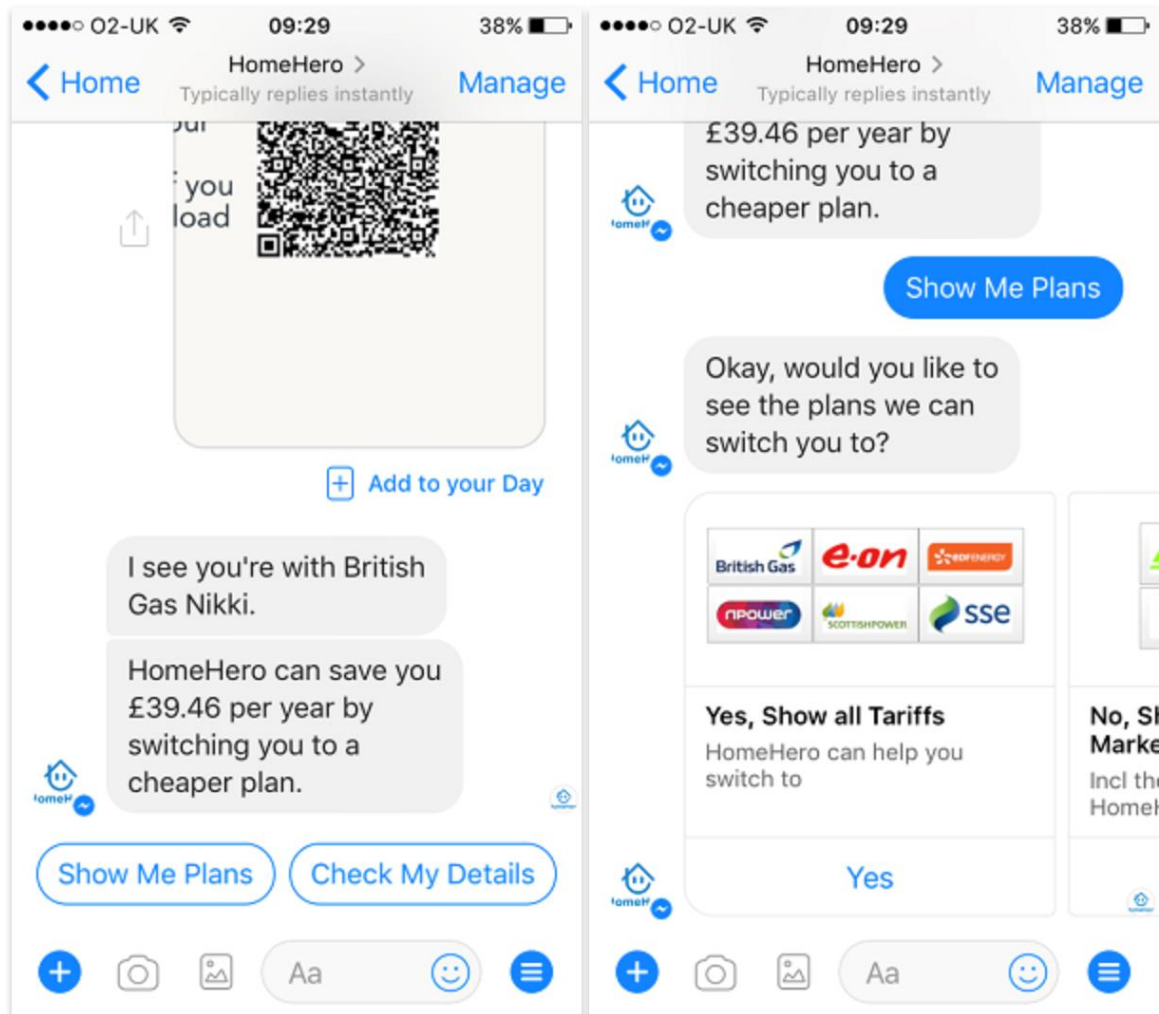
Figure 9: HomeHero messenger chat

Figure 10: Sentimer Energy chat-bot

Figure 11: Sentimer energy chat-bot features

4.4. Focus group

During the workshop, 3 utility customers were interviewed in person using a questionnaire that was prepared by KAT. The aim of the interviews was to get some initial feedback on what utility customers think and what their impressions and involvement with a tool like Eco-Bot can look like. This performed survey and its results will also be used as a base for future surveys and questionnaires that need to be performed in the following project tasks and will be analyzed by KAT.

The first part of the questionnaire covered several topics, where the following was addressed:

- Environmental awareness
- Electricity consumption awareness
- Energy efficiency topics awareness
- Interest in energy efficiency solutions
- Willingness to pay for energy solutions
- Interaction channels used and preferred to interact with the electricity provider
- Impressions on a tool like eco-bot

The second part of the questionnaire concerned feedback on the questionnaire. The respondents were asked about their conclusions and suggestions regarding the questionnaire design and questions, in particular:

- Are the questions clearly formulated?
- Should there be more open questions in the questionnaire?
- Are there missing answers to choose in the closed questions?
- Is there an adequate number of questions?
- What other questions can be asked?

Based on the obtained answers, conclusions will be drawn which will help KAT in formulating questionnaires for various groups of respondents. General conclusions from the conducted interviews concern:

- The need to clarify the wording of some questions (e.g. question concerned with the economic situation of the respondent)
- Asking additional questions, e.g. regarding devices that generate the highest electricity consumption, the size of the house/flat, information about people living in the house/flat
- The possibility of eliminating some of the proposed answers in closed questions.

- The need for one more preliminary examination before the final questionnaire survey. Such research is planned for a larger group of consumers in Poland at the turn of February and March 2018.

Respondents also acknowledge that the number of questions (about 20 to maximum 30 is optimal and the questionnaire should not be extended as it will discourage the surveyed people. Answering questions from the first part of the survey, respondents drew attention to the problems related to the low level of ecological awareness of energy consumers, which may affect their understanding of some questions. They also formulated general recommendations on the way the Eco-Bot functions and looks – respondents agreed that Eco-Bot should have human characteristics to communicate effectively with the users.

The full questionnaire can be seen in ANNEX B.

5. In continuation of the Opening Workshop: User Requirements comprehensive elaboration

As mentioned earlier, in section 3.4, elaborating user requirements is a process that needs time, and will be constantly underway. As the project progresses further requirements become evident or simply change and the project needs to be able to absorb all these changes and be dynamic enough to finally deliver what the user really needs. For this reason, the workshop outcomes were treated as a first high-level approach to defining user requirements, and further activities were undergone after the workshop to enter more in detail. As mentioned earlier these user requirements will be developed, filtered, and concreted further as the project is progressing as recommend by the Agile method (Agile Business Consortium Limited, 2014).

5.1. User stories and Jobs to be done exercise

User stories are requirements "expressed from the perspective of an end-user goal", and are "the most popular way of expressing user requirements in Agile (Agile Business Consortium Limited, 2014), this is due to the following reasons, a user story:

- "Focuses on the viewpoint of a role who will use or be impacted by the solution"
- "Defines the requirement in language that has meaning for that role"
- "Helps to clarify the true reason for the requirement"
- "Helps to define high level requirements without necessarily going into low level detail too early"

Jobs to be done is an alternative way of expressing requirements that focuses on the situations and motivations (Jupiter, 2017), while user stories focus on the person and their role. Jobs to be done can be useful when a certain situation or need is not restricted to one

kind of person or user and has been becoming an increasingly popular tool for defining user requirements.

Depending on the situation and the need, one or the other might be a better way of expressing a user requirement (Gothelf, 2017). Thus both approaches were considered in elaborating the user requirements of Eco-Bot.

A user story is elaborated as follows (Agile Business Consortium Limited, 2014):

As a <person>, I want to <action>, so that <expected outcome>.

While a job to be done story is elaborated as such (Jupiter, 2017):

When <situation>, I want to <motivation>, so I can <expected outcome>.

After the opening workshop, every partner responsible for a pilot, namely Estabanell, Senercom, and Dexma, elaborated a set of requirements, based on the user stories and jobs to be done frameworks. The common user requirements of Estabanell and Senercom were then combined, as they both address residential end users that share certain aspects despite being located in Germany and Spain. The residential user requirements were then classified into common themes, and addressed in the user requirement workshop, in the Eco-Bot plenary meeting in Athens on May 3rd 2018, along with Dexma's user requirements for facility managers.

5.2. Athens Plenary Meeting: user requirements workshop

During the Athens Plenary meeting a workshop was dedicated to addressing the user requirements. The aim of this workshop was to go through the list of user requirements defined independently by each pilot, get the input from the other partners both from a user and technical point of view, and prioritize the requirements.

Different consortium members attended the workshop, namely Estabanell, KAT, Dexma, Plegma, Adelphi, Senercon, and Risa. And the workshop results were then presented and discussed with the whole consortium.

The workshop consisted of 3 parts:

- User requirements, presentation, voting, and prioritization. This was the bigger part of the workshop where the user requirements of each pilot were presented, voted upon by all the workshop participants, and finally prioritized (leaving a final deciding power to the pilot).
- Discussion on inspiring ideas. The workshop participants were asked beforehand, to try out some existing bots. These bots did not address issues related to energy, but the aim was that the participants gain a sense of feel of what it can be like to interact with a bot. A discussion on inspiring ideas, and positives and negatives of each bot

![eco-bot logo]
eco-bot
let's talk energy!

30

then took place. The bots tested included Replika, Poncho, and FoodNetwork among others.

- Quick prototyping. Using the tool by bot society (https://botsociety.io/) two prototypes of Eco-Bot for residential customers, in Spain and Germany, were developed as an exercise so that the consortium begins to imagine what an interaction with Eco-Bot can look like. Dexma also developed a quick prototype in telegram for facility managers.

From the complete list of user requirements, a reduced list was also defined as what can constitute a "basic" version of Eco-Bot for an early implementation.

Photos of the workshop can be seen in Figure 12 and Figure 13.

Figure 12: Prioritization of requirements during the user requirements workshop in Athens

Figure 13: Noted ideas from experiences with other bots

5.2.1. Dexma requirements survey

To help prioritize the user requirements Dexma performed a survey on all its partners (ESCOs, utilities, etc), consisting of more than 250 companies across Europe. The survey was done before the meeting in Athens based on the results related to facility mangers in the Opening Workshop. It asked Dexma's partners, several questions regarding what they would like the chat-bot to answer and assist them with, also suggesting the functionalities that were discussed in the opening workshop. This Survey later helped further define and prioritize the user requirements outlined by Dexma in the meeting in Athens. Table 12 shows the priorities of facility managers as they were expressed in the survey.

Table 12: Priorities set by facility managers

Facility expressed priorities	Ranking
Weekly metrics	1
Recommendations engine based on NILM	2
Smart alarm engine, updating of both positive and negative aspects (via graphs), this engine must be related to the recommendations	3
Detection of behavioral changes, Eco-	4

bot could detect potential inefficiencies and changes that are achieved, related to the list of energy efficiency measures	
Confirm that information is gathered properly from a HW	5
Comfort features	6
Notifications for approaching deadlines of contracts	7
Prioritization of buildings for facility managers who manage a lot of buildings on their portfolio and want to maximize energy savings	8
Schedule visits or actions with external vendors, inform about them	9
Benchmarking with similar buildings for each sector	10
Tracking of energy savings via IPMVP or similar methodology	11

6. Utilization and application of Task 2.1 results

As previously mentioned, Task 2.1 included the opening workshop as well as a set of activities prior and posterior to it. The whole set of activities had a direct or indirect impact in the development of Eco-Bot for the different pilots and use cases.

With respect to the activities performed before the workshop (market research on existing chat-bots and the input from Select MSc. Students), the outcomes were primarily useful on the effectiveness of the opening workshop itself. The realization of these activities with time allowed to have the right starting point during the workshop and reach deeper discussions and conclusions, which would have been less fruitful without this previous preparation. The prior activities also allowed the display of the different approaches in different European countries and increased the applicability of the workshop to the different project contexts.

During the workshop, as detailed above, three main categories of topics were addressed, all of them contributing to the different pilots in the respective areas. Regarding the consumer focus, a list of key success factors, which define Eco-bot as a successful project were reached, based on the end-users it is addressed to. These factors are useful for all pilots while they are shaping their bot's structure and functionalities because they can be seen as a roadmap or must-have points to consider during the development of technical or

functional specifications, which were later considered separately for every pilot. The consumer focus also opened key questions to which answers will need to be developed for every context in which Eco-Bot will be applied.

The second activity during the workshop addressed the policy and legal issues involved in the project. The main outcomes from this are very useful to all pilots to ensure that the project is following the necessary legal framing from the start. Despite that the speakers come from the Spanish legal Framework, several points were pointed out on a European level, and the presence of Senercon and Dexma greatly enhanced the discussion as well, with their deep knowledge of their respective markets and legalities in the UK and Germany, where they are already offering energy efficiency services.

The other important aspect considered during the workshop was to embrace the opinion from experts in the field, coming from outside and within the consortium itself. In addition examples were highlighted from other successful projects or individual ideas that are considered to be key characteristics on the bot's implementation. All pilots benefited from these ideas and advice and can judge the need to adapt it according with the pilot specific context.

The last point addressed in the workshop was the focus group, where interviews were made with utility customers in order to have a first impression of what are the customer needs. The results from this activity are mainly useful for residential clients, more specifically in the Spanish context, as the participants were Spanish. However, this is only a preliminary exercise that is further expanded in WP3, nevertheless it has provided insight on how to approach clients and phrase questions.

As highlighted before, the workshop was not the end of this task. A sequence of activities that focused on user requirement specification followed which was important for all pilots to reach this important phase of the project development. All pilots did the user stories and jobs to be done exercises transversally and the results from these activities were the base for writing the specific user requirements per pilot. This task of defining user requirements started at this point, and basic and extended lists of requirements were defined. However, user requirement definition is not a task that will end at this point, as these requirements will be constantly reviewed and further detailed as the project progresses. WP7 will also be able to give important feedback to the requirements as exploitation plans become more concrete and the understanding of the existing markets more mature, allowing maximum value and exploitation potential.

Nevertheless, a comprehensive list, a concrete first approach and starting point is now available. The result of this exercise was passed on to Task 2.3, and the full lists can be seen in D2.3. This was extremely useful for D2.3, as it further allowed a customer segment mapping to requirements of interest.

Apart from the insight into the user requirements, the results of T2.1 allowed a better understanding of the end users, which was quite useful for an understanding of the different segments in T2.3. The contribution of the partners from the pilots throughout the activities of T2.1 also fed into T2.3 and helped make sure the segments defined were a good match to the applications of Eco-Bot in its different contexts.

7. Conclusion

The workshop got together the consortium with external participants and was fruitful in bringing out important issues that need to be considered in upcoming parts of the project. It was further supplemented by activities performed before and after the workshop that enhanced the workshop content from one side, and built on it from the other.

Consumers and their needs were extensively discussed, and the best way to reach out to them was brainstormed resulting at the end of the workshop in a list of key success factors for Eco-Bot.

Eco-Bot was also considered from a policy and legal framework, and the aspects in which it can be limited or promoted by policy issues were discussed.

Different parties also gave their opinion on the project from within and outside the consortium, making both specific and general recommendations, and outlining existing solutions. Two lists of desired features from the viewpoint of facility managers and residential customers were gathered, from which the project can move forward to select those features that are the most realistic to implement and provide the most value added. The features and user requirements were then expanded upon after the opening workshop, through work performed by the pilots, and in the plenary meeting in Athens.

Customer engagement is not a straightforward task and is quite complex to achieve successfully, especially in topics were not all end users are sufficiently informed or aware. Eco-Bot needs to take into consideration all the different aspects affecting customers and how to reach them to effectively achieve its goal.

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ANNEX A: BeeData Bills

BeeData Bill sample 1:

BeeData Bill sample 2:

estabanell *energia*

Full 2|2

ÚS DE L'ENERGIA

Aquest mes has consumit

196 kWh

-29%
Respecte al mes anterior

+0,1%
Que el mateix mes de l'any anterior

219 203 196 207 215 207 196 157 219 208

Gen Feb Mar Abr Mai Jun Jul Ago Set Oct Nov Des

Ús de l'energia kWh

Consum 2016
Consum 2017
Previsió consum

LA NOSTRA PREVISIÓ RESPECTE L'ANY ANTERIOR

-12%
Agost

+3%
Setembre

-8%
Octubre
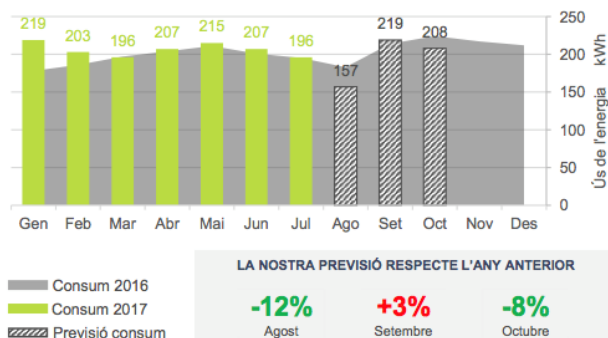
EL TEU ÚS COMPARAT AMB LLARS SIMILARS

228 kWh
Llars similars

196 kWh
El teu consum

134 kWh
Llars eficients
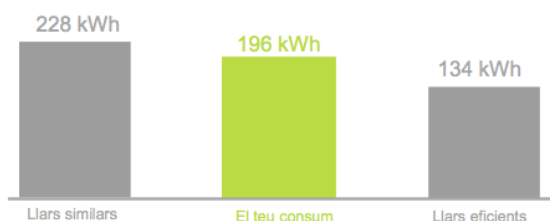
Enhorabona! T'estàs acostant cada cop més a les llars més eficients, continua així!

CONSELLS PER ESTALVIAR ENERGIA

Bons hàbits
Abans d'obrir la nevera, pensa que en vols agafar, evita tenir-la oberta massa temps.

Tip
Cuinar amb microones utilitza menys energia. El microones requereix menys aigua i energia per cuinar els aliments.

Sabies que...
Els ordinadors portàtils utilitzen un 90% menys d'energia que els ordinadors de sobretaula?

ATENCIÓ EXCLUSIVA CLIENTS: 900 250 260 / info@estabanell.cat / www.estabanell.cat

ANNEX B: Focus group questionnaire

Dear Sir/Madam

As a part of Eco-Bot research project, we would like to know your opinion about some key questions regarding the energy consumption and IT technology.

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

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 (place the X sign in the appropriate box):

1. Based on your opinion, which of the following has a negative impact on the environment in your country?

   ☐ Petroleum consumption of individuals (i.e., gasoline/diesel)

   ☐ Electricity consumption of individuals

   ☐ Water consumption of individuals

   ☐ Natural gas consumption of individuals

   ☐ Other, give an example……………………………………………………………….

2. Do you know/understand how you can optimize your electricity consumption?

   ☐ Yes

   ☐ No

3. Do you control your electricity consumptions?

☐ Yes
☐ No

If not what is/are the reason/s?

What factors would most encourage you to plan your energy use?

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

☐ Yes
☐ No

5. Which organizations do you trust to inform you about actions you can take to optimize your electricity consumption?

6. Are you aware of electricity management programs?

☐ Yes
☐ No

If yes, please name them.

7. Did you ever change your heating system?

☐ Yes, how many times, during last 5-10 years…………………………………………
☐ No

If yes, what was the reason to do so? Based on your opinion, what are the barriers of your engagement towards increasing energy savings?

8. What factors would most encourage you to use electricity management programs?

9. Which of the following statements would most likely cause you to take action?

☐ Stop wasting money. Turn off the lights
☐ Be energy efficient. Turn off the lights.
☐ Save the environment. Turn off the lights.
☐ Stop wasting energy. Turn off the lights.

☐ Save the future. Turn off the lights.

☐ Conserve energy. Turn off the lights.

10. If you had a variable rate plan, what would you most expect from your energy provider?

☐ Early notifications when my bill might be higher than normal (e.g., higher than last month, higher than the same month in the year before, etc.)

☐ General advice on actions I could take to lower my bill

☐ Notifications when the price of energy is changing (e.g., display in my home, SMS/text message, notifications via chat-bot etc.)

☐ A device that automatically adjusts my energy use (i.e., automatically turns off appliances when costs are increasing)

☐ Insights into factors that may have caused my bill to increase (e.g., extra cooling or heating because of the weather, etc.)

☐ A free in-home energy audit with customized recommendations on how I can better manage my energy costs

☐ A weekly summary of my energy usage

☐ I would not expect any specific services from my energy provider if I had a variable rate plan

11. 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.)?

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

☐ Yes

☐ 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)?

☐ Yes

☐ No

13. Which of the following characteristics are the most important when you consider using self-serve channels to interact with your electricity provider? (Indicate the 3 most important)

☐ Resolves my request the first time

☐ Simple and easy to use

- ☐ Technical support is available whenever I need it
- ☐ Keeps my information private and secure
- ☐ Provides tools to understand my usage and get tips to reduce my bill
- ☐ Faster than speaking to a representative
- ☐ More convenient than speaking to a representative

14. How do you appraise your economic situation?
- ☐ Very good
- ☐ Good
- ☐ Neither good or bad
- ☐ Bad
- ☐ Very bad
- ☐ no answer

15. Would you trust a digital assistant that would like to chat with you?
- ☐ Yes
- ☐ No

If not, why

16. How do you imagine his portrait, if you had to draw it? Please draw an example

17. How would you challenge him? Don't be too strict, it is his first contact with you ;-).

18. Would you like him to contact you and remind you from time to time, let's say every month?
- ☐ Yes
- ☐ No

If not, why

19. What are the energy related issues you are interested in?

II. Now, please answer some questions regarding this questionnaire

1. Do you think that this questions are understandable?

    ☐ Yes
    ☐ 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?

    ☐ Yes
    ☐ No, these questions are enough
    ☐ No, these questions are too many

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

    ☐ Yes
    ☐ 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.