Deliverable D7.5
Report on Market Environment

adelphi
June, 2021

www.eco-bot.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 767625

D7.5: Report on Market Environment

Summary

Deliverable 7.5 analyses the market environments of the three Eco-Bot pilots (April 2020 to May 2021). The Eco-Bot pilots were affected by a multitude of regulations and policies, both on an EU-wide level and by national legislation. These include energy effiency directives and data protection regulations as well as policies that regulate smart meter rollout. Moreover, the deliverable portrays barriers and challenges encountered by the three Eco-Bot pilots. These include user recruitment and engagement registrations problems – partly induced by the Covid-19 pandemic – as well as data access and security concerns by users. The deliverable also formulates lessons learned derived from the pilots and identifies recommendations for the Eco-Bot joint venture after the project's end.

DELIVERABLE NUMBER	WORK PACKAGE
D7.5	WP7
LEAD BENEFICIARY	**DELIVERABLE AUTHOR(S)**
adelphi	Kathrin Kohl (adelphi) Joscha Gretzschel (adelphi) Lena Domröse (adelphi) Oriol Pla (DEXMA) Chloé Coral (EYPESA) Claudia Julius (SEC)
QUALITY ASSURANCE	
Reviewer 1: Oriol Pla Reviewer 2: Claudia Julius	DEXMA SEC
PLANNED DELIVERY DATE	**ACTUAL DELIVERY DATE**
30/04/2021	29/06/2021
DISSEMINATION LEVEL	x PU = Public □ PP = Restricted to other programme participants □ CO = Confidential, only for members of the consortium

Table of contents

D7.5: Report on Market Environment 1

Summary 1

Table of contents 2

List of Acronyms and Abbreviations 3

Executive Summary 5

1. Introduction 6

2. Review of relevant Governance Frameworks for the Eco-Bot Project 7

2.1. Relevant Regulations 7

2.1.1. European Level 7
2.1.2. Germany 9
2.1.3. United Kingdom 9
2.1.4. Spain 10
2.1.5. Greece 11
2.1.6. Italy 12

3. Eco-Bot Market Environment: Barriers and Challenges 14

3.1. SEnerCon: Specific barriers and mitigation actions 14

3.2. DEXMA: Specific barriers and mitigation actions 16

3.3. Estabanell: Specific barriers and mitigation actions 18

4. Summary of Lessons Learned 21

4.1. SEnerCon 21

4.2. DEXMA 22

4.3. Estabanell 22

5. Recommendations for Improving the Uptake of an Effective ICT Tool 24

5.1. For Policy Makers 24

5.2. For Businesses 25

5.3. Further recommendations resulting from the pilots 26

6. Conclusion 28

List of Acronyms and Abbreviations

BIM	Building Information Modeling
CNMC	Spanish National Market Competition Commission
CSR	Corporate Social Responsibility
DoW	Description of Work, referring to the Annex I of the Grant Agreement
DPA	Data Protection Act
DSO	Distribution System Operator
EU	European Union
EMS	Energy Management Service
EPBD	Energy Performance of Buildings Directive
ESCO	Energy Service Company
GDPR	General Data Protection Regulation
ICT	Information and Communications Technology
iESA	Energy Savings Account
ISACA	Spanish Information Systems Audit and Control Association
KPI	Key Performance Indicator
kWh	Kilowatt hours
LSSI	Spanish Law on Information Society and Electronic Commerce
Mtoe	Million Tons Oil Equivalent
NILM	Nonintrusive Load Monitoring
NZEB	Near Zero-Energy Buildings
PLC	Power-line communication
PV	Photovoltaic
RED	Renewable Energy Directive
UVP	Unique Value Proposition

UK	United Kingdom

Executive Summary

Deliverable 7.5 analyses the market environments of the three Eco-Bot pilots (April 2020 to May 2021) and identifies challenges encountered. The project team formulates lessons learned that are relevant for the Eco-Bot joint venture after the project's end (see D 7.3). Moreover, chapter 5 formulates recommendations for policy makers and businesses that foster the uptake of ICT tools such as Eco-Bot.

Since the pilots operated in different countries – UK, Germany, Spain and Italy – they had to ensure compliance with EU and diverse national regulations that directly and indirectly influence Eco-Bot's operation. While national implementations of the EU GDPR are similar to one another, other regulations differ from country to country. The EU Energy Efficiency Directive, the Energy Performance of Buildings Directive, the Eco Design and Labelling Directive and other EU policies indirectly influence Eco-Bot. These directives shape a market environment characterized by increased awareness for energy efficiency and the need for tools such as Eco-Bot to facilitate more efficient energy usage.

The most important barriers and challenges of the Eco-Bot pilots were: problems with participant registration, user recruitment, and engaging people to actively use Eco-Bot. The Covid-19 pandemic exacerbated these problems. Participant registration was time-consuming for the users / facility managers. The issue with user recruitment relates to data access and security concerns by users and can partly be ascribed to ineffective user communication channels. Engaging the users proved to be challenging due to a decreasing interest of some users.

The project team identifies **four key lessons learned** that will point the way to successful market roll-out of Eco-Bot: 1) personal communication is an effective way to motivate users for participation and to receive feedback on Eco-Bot's features and its recommendations (Senercon and Estabanell), 2) the exchange with smart meter companies is useful and can enhance successful market roll-out (Senercon and Estabanell), 3) a more holistic integration of Eco-Bot in the Energy Management Service (EMS) / utility webpage can improve usability and user experience (Dexma), 4) a high level of language proficiency and the use of local language positively influence continuous use of the bot (Senercon and Estabanell). Despite some national market and regulatory differences, compliance with regulations is manageable and Eco-Bot should experience successful market roll-out (acc. to D 7.3). According to the outcomes and the findings in D7.3, the most promising markets for the first introduction of Eco-Bot are Germany, Spain and Greece.

The Eco-Bot pilots show that there is unexploited potential to promote the uptake of effective ICT tools through well-designed policy and legislation. Therefore, the recommendations disclose the need for an improved and harmonized data availability across the EU, especially when it comes to smart meter roll-outs.

1. Introduction

Deliverable D 7.5 is based on task T 7.3 (Outside-in report in Eco-Bot market conditions) and describes the market conditions that Eco-Bot encountered in the specific target countries of the three pilots. It shows which market environment Eco-Bot will enter into after the project phase (as in D 7.3) and summarizes the lessons learned from the three pilot cases. In contrast to D 7.3, in which a detailed market analysis is portrayed, this deliverable D7.5 depicts the market environment and the setting the joint venture will operate in.

Furthermore, this deliverable identifies barriers and challenges encountered during the pilot phase and describes mitigation actions taken by each pilot. It also identifies policy frameworks relevant for the uptake of Eco-Bot, both on an EU-wide and national level. Finally, D 7.5 gives concrete recommendations, both for policy makers and businesses, aimed at promoting the uptake or diffusion of energy efficiency measures and tools like Eco-Bot.

The deliverable consists of six chapters. Chapter 1 presents the aim and the structure of the deliverable. Chapter 2 reviews the most relevant governance frameworks that impact Eco-Bot. Here, the impact of regulations passed by the European Commission is assessed first, before the respective target markets Germany, United Kingdom, Spain, and Italy are assessed individually. Chapter 3 presents identified barriers to Eco-Bot's dissemination. The barriers and mitigation actions by the respective pilots SEnerCon, DEXMA, and Estabanell Energía are evaluated. The following chapter 4 summarizes the lessons learned by Eco-Bot's pilots, while chapter 5 presents recommendations for a) policy makers regarding smart metering, behavioral change for energy consumers and funding for projects similar to Eco-Bot and b) for businesses on how to use Eco-Bot most effectively. The closing chapter 6 presents a conclusion of the deliverable.

2. Review of relevant Governance Frameworks for the Eco-Bot Project

2.1. Relevant Regulations

2.1.1. European Level

In recent years, the European Union has implemented several policies that indirectly promote the uptake of chatbots such as Eco-Bot in its member countries. With the passing of the Energy Efficiency Directive 2012/27/EU and its 2018 amendment, the EU is requiring all member states to decrease the final energy consumption. Specifically, the EU targets a 32.5% decrease in energy consumption in 2030 compared to 2007 projections. This amounts to a maximum of 1 273 Mtoe of primary energy consumption and 956 Mtoe of final energy consumption to be allowed in 2030.[1] To achieve this target, the EU requires its member states to reduce their energy consumption by 0,8% each year from 2021 until 2030.[2] Additionally, European energy utilities are required to achieve yearly energy savings of annual sales to final consumers.[3] This directive is especially beneficial for the uptake of Eco-Bot, as potential customer utilities could use Eco-Bot to educate and advice their consumers on how to improve their energy efficiency.

Further legislation to improve energy efficiency was introduced in 2010 with the Energy Performance of Buildings Directive 2010/31/EU (EPBD) and its amendment in 2018. This broad policy directive aims to achieve a decarbonized and highly energy efficient European building stock by 2050. In order to do this, the EPBD requires all new buildings to be Near Zero-Energy Buildings (NZEB) from 31 December 2020 on.[4] Moreover, EU countries must set national energy performance requirements for new and to-be-renovated buildings. The directive also includes an optional scheme for rating the "smart readiness" of buildings, with which smart technologies controlling the energy consumption of buildings shall be promoted.[5]

Accompanying the EPBD, additional efforts to improve the energy efficiency of the European building stock are brought forth by the Renovation Wave Strategy as part of the European Green Deal. This strategy aims at doubling the current rate of energy renovations of buildings.[6] Currently, only 1% of buildings are subject to energy efficient renovation each

[1] http://data.europa.eu/eli/dir/2018/2002/oj Last Accessed: 27 April 2021
[2] For Cyprus and Malta, the EU requires only a 0,24% decrease in energy consumption annually.
[3] https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/obligation-schemes-and-alternative-measures_en?redir=1 Last Accessed: 27 April 2021
[4] https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en#energy-performance-of-buildings-standards Last Accessed: 27 April 2021
[5] https://ec.europa.eu/energy/sites/ener/files/smart_readiness_buildings_implementing_act_c2020_6929.pdf Last Accessed 27 April 2021
[6] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122220757&uri=CELEX:52020DC0662 Last Accessed 27 April 2021

year.[7] Additional relevant legislation for Eco-Bot includes the recast Renewable Energy Directive 2018/2001/EU (RED II), setting a new binding requirement that 32% of all energy consumed in the EU by 2030 needs be generated by renewables.[8]

While on the surface, the RED II, the EPBD and the Renovation Wave do not affect Eco-Bot directly, the policy environment shaped by these directives undoubtedly highlights the importance of energy efficiency. As Eco-Bot is designed to be a tool for consumers to easily form energy efficient consumption habits, the chatbot perfectly fits the frameworks of the described policies. Therefore, the presented legislation should be beneficial for the promotion of Eco-Bot, even though it does not target Eco-Bot's operation specifically.

In contrast, the EU has also established widely-adopted regulation regarding the design and energy labelling of consumer goods that directly affects Eco-Bot. Regulation 2017/1369/EU enables customers to make informed choices based on the energy consumption of energy-related products, as this regulation makes it obligatory to display the energy consumption of household appliances such as dishwashers and refrigerators.[9] This enables an easy comparison between products not only by purchase price but by energy consumption and their subsequent usage costs. For Eco-Bot, this is important as the bot is designed to give consumers recommendations to replace energy-intensive appliances with more efficient ones, based on the labelling information. The Ecodesign Directive 2009/125/EC is supporting this effort by setting minimum standards for energy efficiency for household appliances.[10]

Eco-Bot is also directly affected by the Network and Information Systems Security (NIS) Directive 2016/1148/EU, as it establishes common security standards for electronic communication tools.[11] Moreover, the European Union's General Data Protection Regulation (EU GDPR) provides general rules regulating the usage of consumer data. In Deliverable D1.3, the consortium described in detail how Eco-Bot ensures its compliance with the provisions of the GDPR. This GDPR has been frequently adapted and expanded for data protection legislation within the individual EU countries. The following subchapters will describe how this impacts Eco-Bot.

[7] https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en#a-renovation-wave-for-europe Last Accessed 27 April 2021
[8] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC Last Accessed 27 April 2021
[9] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2017.198.01.0001.01.ENG Last Accessed 25 May 2021
[10] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009L0125 Last Accessed 25 May 2021
[11] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016L1148 Last Accessed 25 May 2021

2.1.2. Germany

D 7.3 accentuates that Germany is one of the markets were Eco-Bot should be introduced first in the near future (please refer to chapter 4 of D 7.3 for a detailed market analysis). The German regulatory landscape was relevant for SenerCon's pilot. In particular, two federal laws affected the piloting phase of Eco-Bot and will be significant for Eco-Bot's commercialization.

In Germany, smart metering is not yet obligatory for all residential buildings. The federal law on metering point operation and data communication in intelligent energy grids ("Gesetz über den Messstellenbetrieb und die Datenkommunikation in intelligenten Energienetzen") is regulating the application of different analogue, modern and intelligent metering systems within different validity and implementation periods.[12]

All analogue meters must be replaced until 2032 by modern metering systems without data communication components that are storing daily, weekly, monthly, and annual energy consumption data (for a two-year period) but that can be upgraded by such a communication component. The upgrade would be an intelligent metering system that can retrieve 15 min. interval data and is combined with a smart metering gateway that is automatically transferring the data to the metering point operator.

The German law "Gesetz zur Digitalisierung der Energiewende" (Law on Digitization of the Energy Transition) regulates the obligation of smart meter installation for private households with an annual electricity consumption between 6,000 and 10,000 kWh until 2020 and a total obligation for all households until 2032. As a lot of Eco-Bot's functionalities can only be used in connection with a smart meter, the smart meter roll-out foreseen in both legislations described above will enhance Eco-Bot's attractiveness on the German market.

2.1.3. United Kingdom

DEXMA has several customers (mainly ESCOs and utilities) in the UK.[13] Therefore, the UK regulatory landscape was relevant for DEXMA's pilot, as it is one of DEXMA's main markets.

As the UK has left the European Union, the EU GDPR does no longer apply to UK citizens and businesses. Instead, data protection is regulated by the Data Protection Act of 2018 (DPA). As the DPA was enacted to translate the requirements set in the EU GDPR into UK law, the provisions are largely the same under both legislations. The fundamental change in data regulation since Brexit pertains to the supervisory body, as this power no longer is held by the EU officials, but by the UK information officer.[14] Thus, the Eco-Bot joint venture needs

[12] http://www.gesetze-im-internet.de/messbg/index.html Last Accessed 27 April 2021
[13] According to the findings in D 7.3 the UK market will not play a central role for the commercialization of Eco-Bot. Nonetheless, it is mentioned in this deliverable D 7.5 for the sake of completeness with regard to the market conditions of Dexma's pilot.
[14] https://www.whitecase.com/publications/article/gdpr-guide-national-implementation-united-kingdom Last Accessed 27 April 2021

to be aware of any future changes in data protection rules enforced by this office, instead of relying solely on EU-wide regulation.

Besides the DPA, Eco-Bot's operations need to comply with the Privacy and Electronic Communications Regulations (PECR), enacted by the UK government in 2003 to implement the EU's ePrivacy Directive 2002/58/EC. The PECR introduces specific rules for marketing activities, such as emails, calls and text, but also regulates the usage of cookies on websites communication service security.[15] As such, the Eco-Bot team needs to ensure compliance with those policies when active in the UK market.

2.1.4. Spain

The Spanish regulatory landscape is relevant for DEXMA's pilot (the restaurants participating in the pilot are located in Spain), as well as Estabanell's pilot. Additionally, D 7.3 accentuates Spain as one of the most important markets for Eco-Bot in the near future (please refer to chapter 4 of D 7.3 for a detailed market analysis). Therefore, this section briefly illustrates the Spanish regulatory landscape.

In order to establish the deployment of smart meters, spanish regulation entails that companies gradually have to replace analog meters with digital meters. Due to the complexity of the process the following was foreseen: by the end of 2014, 35% of the total number of meters with up to 15 kW of contracted power had to be replaced, between 1 January 2015 and December 31, 2016, an additional 35% and between 1 January 2017 and 31 December 2018, the remaining 30%. However, in December 2017, the regulations were modified, giving distribution companies a margin so that they could maintain up to a 2% of the total number of meters without replacement, if duly justified and approved by the National Market Competition Commission (CNMC). Today, more than 99% of domestic electricity meters in Spain are smart meters. The report of CNMC includes that more than 26.8 million smart meters were deployed at the end of 2018.

In the domain of data protection there are different laws that relate to the use of Eco-Bot:

- Organic Law 3/2018, of 5 December 2018, on Data Protection and Guarantee of Digital Rights came into force in Spain. The new law adapts the EU GDPR to Spanish legislation and repeals the previous Organic Law 15/1999. The main novelty presented by the Law is the evolution of a model based on the control of compliance that is now based on the principle of active responsibility, which requires a prior assessment by the controller or by the processor of the treatment of the risk generated by the treatment of personal data to adopt appropriate measures.

[15] https://ico.org.uk/for-organisations/guide-to-pecr/what-are-pecr/ Last Accessed 27 April 2021

- The national law that implements the Network and Information Systems Security (NIS) Directive 2016/1148/EU [16] is Real Decreto 3/2010, of 8 January 2010. It establishes the principles and requirements of a security policy in the use of electronic means that allows adequate protection of the information.

- Guidelines or best practices for designing information systems used in the energy sector were created by ISACA (Information Systems Audit and Control Association) for IT governance and management. As a support tool for managers, Control Objectives for Information and Related Technologies (COBIT) bridges the gap between technical issues, business risks, and control requirements. The COBIT business orientation includes linking business goals with its IT infrastructure by providing various maturity models and metrics that measure the achievements while identifying associated business responsibilities of IT processes.[17]

- Law 34/2002 of 11 July 2002 on Services of the Information Society and Electronic Commerce (LSSI), incorporates into the Spanish legislative system Directive 2000/31/CE of the Council and of the European Parliament regulated aspects of the Information Society Services, in particular those related to electronic commerce. The LSSI establishes for both the providers of intermediation services, the companies that offer their products and the citizens who have a web page, the necessary rules for the use of this network. At the same time, it also regulates possible economic activity generated around the purchase and sale of all kinds of products and services.

2.1.5. Greece

Greece, too, is one of the most important markets for Eco-Bot in the near future (please refer to chapter 4 of D 7.3 for a detailed market analysis). Therefore, this section illustrates the Greek regulatory landscape.

In Greece, the EU GDPR was implemented through Law 4624/2019 ("Data Protection Law").[18] It entered into force in August 2019, without any major deviations from the EU GDPR applicable to Eco-Bot. Further relevant legislation for which Eco-Bot needs to ensure compliance includes Law 4070/2012, on electronic communication and Law 3115/2003,

[16] https://op.europa.eu/en/publication-detail/-/publication/d2912aca-4d75-11e6-89bd-01aa75ed71a1/language-en Last Accessed 18 May 2021
[17] https://www.simplilearn.com/what-is-cobit-significance-and-framework-rar309-article#:~:text=COBIT%20stands%20for%20Control%20Objectives,for%20IT%20governan Last Accessed 27 April 2021
[18] https://www.whitecase.com/publications/article/gdpr-guide-national-implementation-greece Last Accessed 27 April 2021

which further provides provisions for the protection of communications privacy.[19] To successfully operate in the Greek market, Eco-Bot needs to ensure its compliance with those regulations, as well as any future regulations that might be relevant for chatbot communication or electricity supply.

The smart meter roll-out has been somewhat complicated in Greece. While the development for a smart meter network was approved by law in 2011, it was later challenged due to appeals to the Council of State. Resolving those legal challenges, a five-year development plan for the pilot installation of smart meters for consumers has been introduced by the central Hellenic Electricity Distribution Network Operator (HEDNO), set to install 7.5 million smart meters in Greece within the next six years.[20]

2.1.6. Italy

The Italian regulatory landscape is relevant for DEXMA's pilot, as, along with Spain, the UK and France, it is one of DEXMA's main markets.[21]

The Legislative Decree 102/2014, approved on 04 July 2014[22], is the primary law in Italy that enables smart metering for electricity in Italy. This law transposes the EU Directive on Energy Efficiency (Directive 2012/27 / EU) and its main points regarding Eco-Bot are:

- The obligation for large companies and energy intensive companies to perform energy audits using certified entities every four years.

- This regulation envisages the smart meter enabling requirements preparation by the AEEGSI (Italian Regulatory Authority for Electricity, Gas and Water), which the DSOs are committed to comply with. It also envisages the preparation of activities to provide individual smart meters to the final users.

[19] https://iclg.com/practice-areas/telecoms-media-and-internet-laws-and-regulations/greece# Last Accessed 27 April 2021

[20] https://www.newmoney.gr/roh/palmos-oikonomias/epixeiriseis/deddie-erchonte-75-ekatommiria-exipni-metrites-pou-fernoun-epanastasi-stin-diachirisi-tis-ilektrikis-energias/ Last Accessed 27 April 2021

[21] According to the findings in D 7.3 the Italian market will not play a central role for the commercialization of Eco-Bot. Nonetheless, it is mentioned in this deliverable D 7.5 for the sake of completeness with regard to the market conditions of DEXMA's pilot.

[22] EED implementation in Italy, Concerted Action Energy Efficiency Directive, available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwi8-8L9oLDwAhUqZhUIHTrCCN8QFjAAegQIAxAD&url=https%3A%2F%2Fwww.ca-eed.eu%2Fcontent%2Fdownload%2F3506%2Ffile%2FNational%2520Implementation%2520Report%25202016%2520-%2520Italy.pdf%2Fattachment&usg=AOvVaw1YrITAsXKoPqTdGB7EQKuE Last Accessed: 28 April 2021

- The introduction of annual energy upgrading interventions in public buildings from 2014 to 2020, and intervention programs for the rehabilitation of public and private buildings.

With regards to data privacy, the Legislative Decree No 101/2018 adapted Italian law to the EU GDPR[23], which amended Legislative Decree No 196/2003 setting out the Italian privacy code and entered into force on 19 September 2018. The main specification of national data protection legislation that affect Eco-Bot is the exemption on the data subject's right to erasure and to be provided information if the personal data processing purposes are statistical, related with historical or scientific research or in the public interest.

[23] GDPR Guide to National Implementation: Italy, White&Case: https://www.whitecase.com/publications/article/gdpr-guide-national-implementation-italy Last Accessed: 26 May 2021

3. Eco-Bot Market Environment: Barriers and Challenges

This chapter summarizes barriers and challenges encountered during the pilot phases for all three pilots: SEnerCon, Estabanell and Dexma. A detailed illustration of barriers and challenges per pilot case is given in deliverables D5.2, D5.3 and D5.4 respectively.

3.1. SEnerCon: Specific barriers and mitigation actions

The project team identified four main categories of barriers for SenerCon's pilot in Germany. The following section describes these categories and the respective barriers encountered.

Participant Recruitment and Engagement

One of the main challenges for SEnerCon was the recruitment – mainly at the beginning of the pilot phase - and the retention of reliable participants for the pilot.

Prior to the start of the pilot, a significant number of SEnerCon's users holding an iESA account expressed their interest in participating in the pilot. After the launch of the Eco-Bot pilot, only very few iESA users participated in the pilot. And after some time, several users became "silent" users (i.e. not using Eco-Bot on a regular basis). SEnerCon took further recruitement actions and sent out mailings to more than 3,000 iESA users. The SEnerCon team continued with the recruitment process and took actions (such as direct emailing and phone calls) in engaging the existing users to interact with the bot more.

At the start of the pilot in April 2020 technical problems were one reason why initially interested persons did not further use and interact with the bot. The problems were: Eco-Bot switched to English as chat language, instead of remaning with German language. This confused some users, who subsequently dropped out off the pilot.

User engagement in general proved to be difficult. Users without smart meters lost interest in Eco-Bot, as the bot's functionalities were limited without smart meter data and the users had to manually enter energy data. The project team encouraged users via personalized emails, motivation mailings that promoted Eco-Bot usage, and offering incentives and lotteries. With some active users, a more personal relationship was build.This exchange lead to interesting interviews with some of the users.

In Germany, electricity bills are only sent once a year. This is very often the moment where users are visiting the iESA and enter their energy and cost data of the bill. In other countries like Spain customers get their energy bill every two months, so the occasion to engage with an energy monitoring system occurs more often

The Covid-19 pandemic is one major additional reason why participants lost interest in Eco-Bot. Users had other, very pressing and fundamental worries regarding their health, their jobs, and children's education hence the frequent use of a chatbot on energy efficiency was less than secondary in their lives . Additionally, some users did not have the time to engage

with a chatbot due to increased social and household duties (i.e. child care, home schooling and working from home). These circumstances contributed to a lack of interest to engage with yet another online tool like a chatbot, as time spent with digital tools for web communication increased significantly since the start of the pandemic (screen fatigue).

Smart meter installation

With regard to the smart meter installation, SEnerCon encountered additional barriers. It was challenging to find iESA users that were willing to install Discovergy smart meters in their homes. To mitigate that fact, SEnerCon committed to take over the annual smart metering service charge of € 100 for two years (longer than the pilot duration) and the installation cost for the meters. (After that period, the users would have to pay the annual fee of € 100 by themselves or the reinstallation of a conventional meter of the utility in case they would not like to keep the smart metering service of Discovergy.) Six users were interested in installing a free smart meter in their homes. Of those six, two users had PV installations that disturb the NILM process and thus had be excluded. One user had two metres installed in his home that could not be replaced by a single Discovergy smart meter (which would have been necessary for the use of Eco-Bot, as it can only interact with one meter).

For the remaining users that were still interested in a smart meter, the installation of Discovergy smart meters was set on hold due to the Covid-19 pandemic for several months. When Discovergy restarted the installations, the waiting lists for new customers were too long and the date of installation would have been beyond project lifetime.

In general, for tenants of rented appartments, it is very difficult to install a smart meter in their homes due to administrational processes. In some cases, electricity meters are located outside of the apartments, further complicating the installation process.

In addition to the installation process, the transfer of large data amounts from the smart meters to the iESA proved to be difficult and time-consuming (lasting 36 hours in some cases). This led to users losing interest. SEnerCon's staff convinced them to participate in the project by providing them with personalized support in long support calls.

In some cases, the smart metering data transfer did not run smoothly and data had to be manually re-transferred into the iESA account by developers.

Registration process

The registration to Eco-Bot on the iESA website proved to be more time-consuming than expected and led to users loosing interest. For tracking and evaluation reasons of the Eco-Bot project, each user had to fill in one or two (depending on smart meter installation) questionaires when registering for the bot. After answering these questions, the website enabled the user to click back to their iESA account to finalized the registration. Due to programming reasons, participants were able to start using the bot after a delay of 24 hours, as their data first had to be transferred between iESA and the central backend. SenerCon

took initiated users (by emails and phone calls) to start using Eco-Bot. Some of the users never came back after the initial registration, others were convinced and started to use the bot.

Data protection

In general, German users are rather reluctant to share their data especially regarding smart metering data. This can be ascribed to some critical publications in the press in the recent past. Thus, data security and related questions by some users were a major obstacle to convince people of using Eco-Bot. User asked very specific questions. The SenerCon team managed to dispel doubts by continuously and patiently answeringquestions by phone or email.

3.2. DEXMA: Specific barriers and mitigation actions

The barriers detected during DEXMA's pilot phase and the mitigation actions to address them are described in this section and can be classified into three categories: recruitment, energy management, as well as barriers related to the Covid-19 pandemic.

Participant Recruitment and Engagement

During the recruitment phase before the start of the pilot, DEXMA contacted its partners participating in DEXMA's Beta Tester Programme, whose aim is to share new functionalities and validate them through participants' feedback. Several partners were interested initially, but some partners' interest decreased significantly at the start of the pilot phase. Meanwhile other partners, who had already committed buildings to the pilot were not able to obtain legal permission from the businesses that had given a verbal agreement to share their energy data for the duration of the project: E.g. two hotels located in Andorra. Despite these circumstances, recruitment targets for users and buildings have been met, as described in Deliverable D5.4.

To mitigate these initial recruitment challenges, DEXMA extended its recruitment activities during the pilot phase among its partners and other customers. Towards the end of the pilot, DEXMA was able to recruit ten bank branches to its pilot phase, which were managed by DEXMA's energy management team.

Energy management

The main users of Eco-Bot in the commercial pilot have been energy managers. This is mainly because one of the key elements of the unique value proposition (UVP) is that Eco-Bot saves time as it gives direct energy Key Performance Indicators (KPIs) and insights to the energy managers without having to navigate through several screens and location hierarchies (cf. D7.3). However, energy managers generally found it hard to dedicate time for training and use of the tool, as the time they dedicated to the chatbot was time they could not dedicate to other tasks. Also, the implementation of recommendations given by Eco-Bot

faced a barrier. Often, energy managers did not have the means to validate that a recommendation had been implemented, because many of the recommendations related to behavioural recommendations and involved the participation of the building users. DEXMA mitigated the effect of these barriers by creating training documentation for users and periodically contacting the users to encourage them to use the tool and to give feedback about its use (please refer to D 5.4 for details).

Covid-19 barriers

The non-residential pilot started at the beginning of April 2020, when a lockdown was enforced in Spain, Italy and UK, the countries where the pilot participants are located. The businesses participating at the start the pilot were restaurants, supermarkets, and one hotel. In particular restaurants and the hotel were highly affected by the lockdown, since many were forced to close. In some closed-down businesses technical issues occurred, which could not be solved until after the lockdown. This led to loss of energy data for these periods and subsequently data could not be analyzed. Furthermore, the pandemic put the participating Energy Service Companies (ESCOs) under financial stress, and they shifted their priorities to reinforce their cash-flow and energy managers saw their availability to dedicate time to Eco-Bot reduced. The barriers caused by the Covid-19 pandemic were mitigated partially by increasing DEXMA's engagement with users by sending periodic emails, newsletters, and interviews to users, with the aim of empowering users and obtaining valuable feedback from them.

3.3. Estabanell: Specific barriers and mitigation actions

For Estabanell's pilot, four main barriers were detected thorough the pilot phase: user engagement and communications with clients; contract owner / tenant issue; access to consumption data and translation issues. All barriers are described below.

User engagement and communication with clients

The main barrier for the deployment of Eco-Bot and effective testing of the system was the unwillingness of end-users to take part in the pilot. Unfortunately, the first phase of recruitment was scheduled to take place exactly in the same time frame that the Covid-19 pandemic first hit Europe (please refer to D 5.1 for details). However, even in the months that followed – in which the situation settled down to some degree – raising interest among the residential clients of Estabanell was difficult.

Along with the recruitment activities, a lot of effort was put in the engagement of the registered users. Different strategies and communication tools were applied (such as newsletter, mailing, demo-sessions, webinars, social media posts, price competition etc.) each of them with varying results (please refer to D 5.1 for details). Despite all these efforts, it was very challenging to raise interest among the participants and receive proper user feedback in order for the project to improve and develop as planned. For the same reason, the user survey was only sparsely answered by users. 15 answers were collected for the mid-term evaluation (out of > 50 participants testing the pilot).

Despite of Estabanell's efforts to engage Eco-Bot users, (i.e., monthly newsletters, organized demo sessions, webinars), the results achieved were not satisfactory. What became apparent is that Estabanell lacks an effective digital communication channel. Generally, the social media posts do not entail a lot of views or trigger reactions, and email communication takes place almost exclusively for billing purposes. In theory, Estabanell's client area on the company's website could serve as an alternative communication channel. However, only 30% of the total number of clients are registered to use this service. Therefore, communication through that channel only reaches a fraction of all customers, as 70% percent of all clients simply do not use this form of communication.

A possible reason for the difficulty to communicate with consumers is the demographic structure of Estabanell's costumers. The average client of Estabanell prefers to visit the office or to contact customer service by phone and does not engage with digital tools, a lesson learned during the pilot phase. Thus, it is challenging to motivate the average client to use digital tools and engage her or him through a web application. While this applies to a majority of Estabanell clients, there are still some clients for whom digital communication could be effective, yet it is still to be determined how to reach this type of client open for digital communication in an effective way.

Contract owner / tenant problem

A first barrier to overcome participation in the pilot was being the owner of the electricity contract and the meter of the household. A lot of people living in buildings served by Estabanell are tenants instead of the building owners, and were therefore not able to register for the Eco-Bot pilot. This legal issue of personal data processing is an obstacle for the deployment of Eco-Bot for every type of client.

Access to consumption data

Spanish retailers receive, by regulation, their clients' hourly consumption data once a month from the respective distribution system operators (DSOs) for billing purposes. This low granularity of data access significantly affects the almost real-time monitoring Eco-Bot is able to provide.

As one of the main features of the bot is to monitor the consumption before the arrival of the monthly utility bill, as well as the ability to suggest user corrective actions, a preselection of clients of Estabanell was made at the starting phase of the pilot. Only the clients of both Estabanell Energía and Estabanell Distribució (the DSO of Estabanell, which is legally a separate company) were allowed to be part of the pilot. An agreement was made with Estabanell DSO in order to receive the consumption data with higher frequency and provide a complete service to the user.

However, this was possible only because Estabanell Energía profits from their special relationship with Estabanell Distribució, both being part of the same group of companies, and because most of the clients of Estabanell Energia also belong to Estabanell Distribució. However, a solution to the low granularity of data from DSO providers needs to be found for providing the Eco-Bot service to client companies that operate exclusively as electricity retailers and do not enjoy the same relationships with their respective DSOs as Estabanell. The same is true for client companies that serve a customer base spread among different DSOs.

Even with the described preselection of clients, the problem of incomplete data set remained, though in a minor amplitude. The communication system, working via power line communication (PLC), among smart meters (SMs) and data concentrators has its limitation, and cannot provide high data quality for all clients. The missing consumption data points and the one-hour-granularity of the available data also affected NILM calculation, resulting in a multitude of non-available data periods.

An option that was evaluated to solve those issue during the project was the installation of an advanced meter in the household of the participants. Adding this parallel infrastructure that directly communicates with Eco-Bot backend permits to bypass the DSO to have higher quality real-time data and with a higher granularity than provided by fifth-generation smart meters nowadays installed in Spain. However, this solution requires an installation from a

technician and an intrusion in the clients' households, adding a significant barrier to the uptake of Eco-Bot.

Translation problems

To interact with the users in their native language the bot needs to be customized and adapted to the location of the final end users. It is therefore important for Eco-Bot to be able to provide the recommendations and the narrative content in the specific language. As Estabanell has been part of the Eco-Bot consortium, translation problems (from English to Spanish or Catalan) were easily and quickly resolved when needed. However, future clients will not have access to this shortcut communication. For future dissemination of Eco-Bot, it needs to be considered that an extra step of translation will be needed for every update of the bot.

Furthermore, the wrong intents made by the users (i.e. questions to the bot that it does not understand) need to be understood and, in some cases, the narrative content should be changed or more use cases added. It is even more important in this case that someone in the Eco-Bot joint venture formed after the end of the project phase is able to perform this task, as the conversations cannot be shared with the client utility or ESCO due to privacy concerns.

4. Summary of Lessons Learned

This chapter summarizes lessons learned from the pilot phase of all three use cases.

4.1. SEnerCon

In Germany, it was difficult to recruit and engage users, especially consumers without a special technical background or interest. Although SEnerCon was confident that Eco-Bot would offer a new, modern and more dialogue-oriented approach than the charts and tables of the Interactive Energy Savings Account (iESA), Eco-Bot still required technical knowledge and interest to be used properly. To some users, Eco-Bot was fully not self-explanatory, and users needed personal assistance and guidance by SEnerCon's staff and by manuals for using it and to discover its features. At the same time, SEnerCon's users appreciated the starting menu. From this feedback, it can be derived that additional visual guidance to explain all features of Eco-Bot bot would be useful.

For the frequent usage and testing of new digital tools like Eco-Bot, incentives and lotteries are an effective means of motivation, especially considering the long pilot period. The strategy of recruiting younger people to support their parents in the registration process and the management of Eco-Bot n their homes worked out well.

Personal "on-boarding" to Eco-Bot during calls (i.e. one-on-one support by the SEnerCon team) and several follow-up calls helped people during the registration process and motivated them to further use the bot. This effort proved to be valuable especially for smart meter users as the registration process was time-consuming and complex for some users.

User interviews within online calls were a good means to identify customers' needs regarding new Eco-Bot features and the usefulness of recommendations provided by Eco-Bot.

The collaboration with a smart metering company is a useful option for implementing the pilot. Clients of smart meter installers are already convinced of smart metering and the required technology is already installed in their homes, avoiding delays. The exchange with Discovergy during the collaboration and also during the exploitation workshop brought important insights into the German smart metering market.

4.2. DEXMA

Several lessons were learned with the experience in the commercial pilot. First, the shift of priorities in DEXMA's partners caused by the pandemic had a big impact on user engagement. This made clear that the dedication that energy managers could give to Eco-Bot was limited - as much as it was supposed to save time to users, in the end energy managers had to learn how to use Eco-Bot and go to a separate account with the anonymized buildings to use it. Related with this is the fact that Eco-Bot was integrated with DEXMA Analyse in a separate page in its Analysis section. It was not available to be linked to the rest of pages, therefore the users needed to navigate to the Eco-Bot page every time they wanted to use it. A more holistic integration of Eco-Bot would have increased its time-saving ability for energy managers, in fact, feedback was received from users in this direction.

In addition, several functionalities should be expanded to have a ready-for-market product of Eco-Bot, as energy managers asked to be able to configure alerts, goals and Measure and Verification (M&V) projects with more detail and to track them through the chatbot. Currently, technical partners are working on the improvements reported by the energy managers participating in the pilot phase.

Lastly, account configuration for Eco-Bot was a manual process, which involved account creation, location configuration (energy and temperature devices, tariff and contracts, CO_2 emissions, etc.), user creation, load disaggregation execution and testing. This involved quite some time from the DEXMA team. On the way to the commercialization of Eco-Bot, this process should be one of the first to be optimized and automated when possible.

4.3. Estabanell

As mentioned in the previous chapter, it was complicated to recruit and engage users for testing Eco-Bot. The deployment of the different recruitment strategies helped Estabanell to test and understand which communication channels or tools are effective with their customer base. The best response was obtained when the usage of the bot was coupled with incentives in a competition with prices for the first three winners.

What is clear, however, is that Estabanell needs to invest more time in creating an effective communication channel with its clients beyond delivering the energy bill at the end of the month.

Furthermore, it can be acknowledged that energy efficiency, or more broadly energy in general, is not an appealing topic to most of Estabanell's clients. At the moment it seems the environmental impact of the consumption of electricity is not fully understood or clients do not see enough tangible benefits in monitoring it. The topic is seen as disconnected from their daily life or not important enough for the users to be willing to spend time on the issue. Estabanell should develop a strategy to raise awareness among its clients regarding this topic.

An analysis of the conversations that users had with Eco-Bot showed that the first interaction generally determines if the users will continue using the bot in the future. Conversations that started with a message that the bot did not understand and asked to reformulate, or the bot communicating the unavailability of data as an answer, frequently led users to not log in anymore and prevented them from further investigating the functionalities of Eco-Bot. Therefore, it is imperative to display a flawless first impression. Especially in the case of missing data there needs to be a strategy in place to react to this lack of information. In future updates of Eco-Bot and particularly for its commercialization, it could suggest another period with available data in these specific yet common situations. This applies especially to situations of conversations about appliance consumption. The user does not have an explanation how the NILM works, thus there is a lower tolerance for errors from the user.

In general, the user is not able to intuitively understand by himself that filling the time diary helps improving the NILM algorithm results and he is consequently not proactive enough in completing it. This leads to bad results of the disaggregation and to a loop of frustration for the user.

Finally, even if it was communicated several times and it is also written on the side of the chat window, most of the users from Estabanell still try to communicate with Eco-Bot in Catalan. According to the dialogue analysis, it can take a few messages for the user to understand that he needs to switch languages to Spanish and not reformulate the sentence in order for the bot to understand him. Also, it is very hard to predict how a normal conversation will go and therefore the bot, which has a predefined set of answers, happens to give wrong or nonsense answers when the conversation starts going in a direction that was not planned. In those situations, it is very easy for the user to get frustrated and decide to not come back to the bot anymore.

5. Recommendations for Improving the Uptake of an Effective ICT Tool

This chapter contains recommendations for policy makers and businesses with a view to improving the uptake of an effective ICT tool for energy efficiency, such as Eco-Bot.

5.1. For Policy Makers

In Spain, the Distribution System Operator (DSOs) manages consumption data and shares it for billing purposes once a month. But the DSOs are not the point of contact with the electricity users and therefore cannot offer services, such as Eco-Bot to them. In order for a utility to be able to offer such services to its clients, the access to their consumption data should be facilitated, increasing especially the sharing frequency. As there is currently no incentive for DSOs to do so, regulators should consider creating appropriate incentivizing policies that improves access to consumption data. Initiatives like Datadis[24] a – data lake to share consumption data from associated DSOs in Spain to consumers and authorized third parties – should be incentivized across Europe so that the residential or tertiary consumer can share their main consumption data without the need of installing hardware.

Furthermore, for the NILM to achieve better results, the mandatory frequency of consumption data collection should be improved. Today, the mandatory frequency is only one hour in Spain. The granularity is like this because of the power line communications (PLC) system limitation, which does not allow massive data flow between smart meters and data concentrators. Because PLC cannot support higher granularity of consumption data especially in densely populated zones, other ways of communication should be investigated.

Another way to achieve the same objective (i.e. having better NILM results) could be by promoting the creation of DSO data lakes in the EU for the refinement of NILM algorithms per economic sector. In this way NILM could be further improved and provide higher quality data to its users. Energy data lake projects like Estfeed[25] by the Estonian TSO Elering AS, aim at making energy data from consumers in several EU countries available to third parties. They have the potential to provide large amounts of training data for NILM algorithms and other artificial intelligence-based algorithms for different economic and residentials sectors and climate zones.

Along with those issues, the policy makers should ensure an even smart meter roll-out in all the EU countries. Even if several policies were passed aiming to achieve this, there are still a lot of exceptions and very different levels of smart meter deployment among the different countries. Hence, stricter deadlines should be set by regulators for comprehensive

[24] Datadis: https://www.datadis.es/
[25] Estfeed: https://www.estfeed.eu/en/home

deployment of smart meters across all EU-countries. A big step forward to enhance the roll-out of smart metering and connected services would be that each analogue meter is automatically replaced not only by a modern meter but directly by an intelligent metering system including a gateway to enable storage and further usage of the data. Ideally, this system could be combined with an energy monitoring tool, like the iESA or the monitoring portal of Discovergy. This would enhance the market uptake of new innovative energy services and tools like Eco-Bot.

In addition, governmental incentives should be established that promote the uptake of tools and initiatives like Eco-Bot that aim to reduce the environmental impact of electricity consumption. Possible elements could include tax deductions for utilities for each consumer who lowers their monthly energy demand by a certain percentage of similar mechanisms.

5.2. For Businesses

For businesses, target-group specific messages and respective communication channels will help to promote the need for energy efficient behavior and the use of ICT tools. This became clear during the operation of the three Eco-Bots pilots, as one main challenge was to excite end-consumers about matters related to energy consumption and energy efficiency. This likely applies to ICT tools in general and it is one of the conclusions of the Eco-Bot pilots. Average consumers do not necessarily think about their energy consumption and thus, offering tools to optimize one's personal consumption habits do not sell themselves. Hence, it is essential that businesses selling ICT tools for energy efficiency establish appropriate communication channels to reach their customers. Using clear messages can educate customers on the importance of energy efficiency and their personal consumption. At the same time, it is marketing for the companies' products.

Estabanell's and SenerCon's pilot showed that creating excitement for the use of Eco-Bot (e.g. by regularly promoting it in the bot itself, in newsletters, in energy bill mailings; or by lotteries) can be effective to increase the usage of ICT tools for energy efficiency. Other enterprises active in this field can build upon these experiences.

Users expect a high level of language proficiency when communicating with chatbots. They also expect the bot to properly "speak" their language (e.g. Catalan for Estabanell's pilot and German for SenerCon's pilot). Against this background, businesses developing ICT tools with chatbot functions, that aim at improving energy efficiency, need to focus on the development of a state-of-the-art language-processing algorithm in the local language. Operating the Eco-Bot pilots showed that for any successful ICT tool using chatbot functions, the conversational intelligence of those bots needs to be at an almost human-like level to avoid user frustration. The analysis of user behaviour shows that if a user encounters multiple wrong intents of the chatbot, the user is likely to quit the session and might never use the tool again. The use of graphical elements within the chatbot can facilitate the first interaction and guide the user to the different functionalities of the bot.

For B2B clients that intend to use Eco-Bot (or other ICT tools promoting energy efficiency), the project team recommends a holistic integration of Eco-Bot into their services (i.e. full website integration and consideration of appropriate communication channels). The experiences of DEXMA's B2B pilot show that for ICT tools to be used frequently, they need to be designed in a way that allows for a seamless incorporation of the application into the user's daily processes. If the access to a new tool requires an extra effort or a significant change in routines, the tool is less likely to become an instrument that is used regularly. A possible way to commercialize Eco-Bot is to offer it as a Building Information Modeling (BIM) tool so that facility managers can access information about the building in a quick way (sensors, temperature, setpoints). Algorithms developed for predictive maintenance or anomaly detection integrated with Eco-Bot could send a push notification through the chatbot to the facility manager when some maintenance action or anomaly is detected. This extends equipment lifetime and fosters energy savings.

Benefits for businesses interested in Eco-Bot include customer retention, gaining new customers through image improvement and the integration of Eco-Bot use into a business's CSR-strategy. The latter raises awareness on energy efficiency not only among employees, it also establishes cooperation between team members, which would drive team building in the company.

Apart from pure energy monitoring and management services, EMS platforms could use Eco-Bot to establish new partner networks with energy service companies to share customer bases and to promote energy services through Eco-Bot. For this purpose, Eco-Bot has to be adapted to identify customers that could be interested in these energy services. In addition to the user segmentation of the energy behavioral module, an additional segmentation regarding the market segments of the service providers would have to be introduced. As a simple example, homeowners who have not yet installed solar panels could be addressed by solar panel installers. Vice versa, energy service providers could convince their customers to use the EMS to monitor the effects and successes of their energy service.

5.3. Further recommendations resulting from the pilots

The experiences of the SEnerCon and Estabanell pilots showed – as anticipated - that energy efficiency is not yet a popular topic among residential customers. For many tenants it is hard to see significant economic savings in a short time span. Therefore, it is unlikely to have private households willing to pay for a service like Eco-Bot right from the start. To understand the benefits of a tool like Eco-Bot, end-users need to be able to have a trial period in which they can increase their awareness of energy efficiency, recognize its importance and get a feeling for the saving potential. According to Estabanell's experience, the full potential of Eco-Bot will be unlocked, if utilities can offer this service free of charge to their residential end-consumers, so that as many consumers as possible can better monitor their electricity consumption and increase their efficiency. Offering this service free of charge would in return mean higher costs for the utility without a clear-cut monetary return on investment for the

company. D7.3 also accentuates that the incentive for utilities to offer Eco-Bot does not refer to monetary return, but to customer relations and their retention. The business model foresees (D7.3) that building new and improving existing customer relationships can influence the retention rate of clients and can attract new customers. Once clients are more interested in energy-related topics, the company can better upsell different services, like self-consumption or smart home devices. Therefore, if the customers trust the utility, they are more likely to purchase other services (e.g. security, telecommunications) from them.

6. Conclusion

The three Eco-Bot pilots operated in a multitude of legislations and policies, both on EU- and on national level. As regulatory frameworks change rapidly, the relevance of and the compliance with the various jurisdictions should be monitored by the Eco-Bot joint venture (D7.3).

Several challenges occurred during the pilot phase. They are mainly related to user recruitment and retention and occurred in all of the three pilots. These challenges can, to a large extent, be ascribed to the exceptional circumstances during the Covid-19 pandemic that accompanied the whole pilot phase. Other challenges relate to smart meter installations, registration process and data protection (SEnerCon); contract owner / tenant problem, access to consumption data and translation issues (Estabanell); Eco-Bot training and availability for energy managers (Dexma). All pilots conducted mitigation actions to overcome the challenges.

The deliverable also identifies lessons learned from the pilots. For SEnerCon's pilot, it became clear that incentives (such as lotteries) are a good way to engage and motivate users for participation. The pilot also proved that direct contact with users (such as interviews) was useful for the evaluation and improvement of Eco-Bot's features and its recommendations given. The exchange with a smart metering company (Discovergy) and their users was fruitful and should be considered for the market introduction of Eco-Bot.

In the case of Dexma and the facility managers using Eco-Bot, a major lesson learned was the need to integrate Eco-Bot on a more holistic level on Dexma's webpage. In addition, the energy managers expressed their need on further monitoring functionalities, which can be solved if they were able to monitor their buildings and track them by configuring alerts and goals directly through the bot. For the Dexma team the account configuration was too time consuming and is to be optimized and automated for the ready-to-market Eco-Bot.

Estabanell's central lesson learned is the need for a more effective communication channel with its clients in addition to email exchange (usually by delivering the energy bill at the end of the month). With regard to concrete functionalities of the bot, the language barrier was a special case for Estabanell's clients, as the bot does operate in Spanish (English and German) but not in Catalan. Additionally, misleading narrative content, i.e. questions asked by the users that the bot did not understand right away, is a matter that must be optimized for Eco-Bot's market introduction. All pilots endorse the introduction of a visual guidance of all Eco-Bot features. This ensures a more user-friendly usage of the bot.

In terms of policy and business recommendations, the deliverable shows that cooperating with smart meter companies, distribution system operators and other stakeholders can facilitate the uptake of Eco-Bot. In addition, policy makers could support the dissemination and implementation of ICT tools on energy efficiency, such as Eco-Bot, by enhancing smart meter rollout and designing incentives for the uptake of such tools. As for Eco-Bot's

commercialization, the findings – in particular the lessons learned – will support a successful market introduction.