



REPORT ON THE LIAISON AND CLUSTER ACTIVITIES WITH OTHER PROJECTS

Version 1

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Summary

This deliverable includes the report on every activity made for creating liaisons with relevant projects (national, European and international), as well as with identified standardization bodies from Month1 to Month12 of the project. In the framework of this task, the consortium will pursue new and existing links with relevant bodies, so as to contribute especially with regards to new guidelines and best practices.

The set of activities in order to carry out this task comprised workshops and establishing links nationally, across the EU and internationally, with external stakeholders and research institutions over the aforementioned period in the area of energy efficiency, consumer behavior and market potential and this report details the findings of each and implications for the next steps of the project.

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List of Acronyms and Abbreviations

PPR: Project Progress Reports

PU: Public

WP: Work Package

IEA: International Energy Agency

NILM: Non-Intrusive Load Monitoring

USTRAT: Electronic and Electrical Engineering Department, University of Strathclyde

Executive summary

The aim of this document is to report on Deliverable 6.9, specifically on the liaison activities to identify and establish cooperation with relevant external research institutions and stakeholder groups. At this early stage in the project, focus has been placed on identifying external projects and bodies, nationally, within EU and internationally, for the purposes of knowledge exchange and with a view to enhance market potential of the future Eco-bot project outcomes.

The methodology regarding the liaison and clustering activities was for individual consortium members to first identify external stakeholders, relevant projects and bodies that would meet the objective of this task. The next step was to organise workshops with these external bodies to exchange knowledge, share experience from past projects and efforts on energy efficiency, assess market potential and make links for further consultations focusing on enhancing market potential and maximising user engagement as Eco-bot progresses.

External organisations or bodies and projects were identified and links established are reported.

1. Introduction

1.1. Purpose

The purpose of this document is to report on the various activities undertaken by the consortium to making relevant liaisons with external bodies, such as stakeholders, governmental and non-governmental organisations, consumer bodies, research institutions, and other EU and international projects. The aims of these activities are to exchange knowledge pertaining to energy efficiency measures and how to maximise impact, meeting national, EU and international energy goals, consumer behaviour studies pertaining to energy consumption, existing research, trials and products to enhance consumer-offering and market potential of Eco-bot.

The knowledge gained and liaisons made will refine all beneficiaries' and consortium's actions.

The report is organized as follows. Section 2 describes all liaison and clustering activities with national, EU and international projects, governmental bodies and other stakeholders. Section 3 summarises the findings from these activities and explains how these finds will be embedded into the execution of the project. The final section concludes the report.

2. Liaison and cluster activities

2.1. Scope of the Deliverable

The subsections below summarise the various liaison and cluster activities carried out for the period Month1-Month12 of the project by various beneficiaries in the consortium. This is organised by type of linkage and activity in the following subsections.

2.2. Liaisons with other national, EU, and international projects

The project consortium members have either organised, or participated in, several workshops and other events that facilitated liaisons with other national and EU projects. This includes Athens Research & Innovation Workshop in Building Energy Efficiency, organized by PLEGMA, SENSIBLE Workshop on Smart Buildings and Smart Grids organized by H2020 MSCA-RISE SENSIBLE Project, Transforming Energy Demand through Digital Innovation (TEDDI) Workshop organized by TEDDINET research network. In addition, the consortium members gave a series of seminars at various research institutions liaising with relevant research projects.

2.2.1. Research and Innovation Workshop on Building Energy Efficiency

PLEGMA organized, on behalf of Eco-Bot, the Building Energy Efficiency Workshop, that was held at the National Documentation Center in Athens, Greece, on June 19, 2018 (<http://eco-bot.eu/2018/06/19/presentation-of-eco-bot-in-building-energy-efficiency-workshop-in-athens/>). The event was also an official EU Energy Day, taking part in the "EU Sustainable Energy Week" initiative (<https://www.eusew.eu/energy-days/building-energy-efficiency/>).

During the first session, Eco-Bot coordinator RISA presented the key facts and progress of Eco-Bot and the Eco-Bot team shared views and answered questions on chatbot and disaggregation technologies to partners of other participating Energy Efficiency EU-funded projects, namely BENEFFICE, ChArGED, enCOMPASS, ENTROPY, GAIA, and UtilitEE.

Furthermore, the workshop continued with a very interesting discussion on Business models for Energy Efficient, long-term, user engagement. The workshop, that was deemed successful with more than 35 participants, concluded with a roundtable discussion on future challenges and opportunities in upcoming EU research and innovation calls related to Energy.

2.2.2. SENSIBLE Workshop on Smart Buildings and Smart Grids

A 3-day workshop on Smart Buildings and Smart Grid was organized jointly by USTRAT and multinational engineering design firm Ramboll in Glasgow, UK , on 6-8 June 2018 (<https://sensible.eee.strath.ac.uk/2018/06/08/320/>). The purpose of the workshop was to exchange knowledge on research and innovation carried out within the MSCA-RISE SENSIBLE consortium, enabled by researcher secondments between academic and industrial consortium institutions. The following case studies were showcased through discussions and demos:

- Industrial challenges and state-of-the-art designs for Sustainable Smart Buildings;
- Smart energy, smart grids and energy disaggregation in smart buildings;
- Internet of Things and Smart Energy Efficient Lighting in smart buildings;
- Indoor localisation and positioning; Smart parking systems for Energy Management

Sandpits were organised on sensing, communications, data processing and integration challenges. Attendees comprised members of the SENSIBLE consortium, which include University of Strathclyde, University of Novi Sad, University of Zilina, Spanish National Research Council CSIC, University of Sydney, Tongji University in Shanghai, McGill University, National Informatics Institute Tokyo, Ramboll, PanonIT and Scheidt and Bachmann.

Besides disseminating Eco-bot with the workshop participants, valuable knowledge was gained on remaining research and innovation challenges to be tackled for technology Report on the Liaison and Cluster Activities with other Projects / Report / Document

development and market deployment within the Sustainable Buildings area. Valuable liaisons were also made with researchers and innovation staff from academic and industrial beneficiaries and partners in the SENSIBLE consortium.

2.2.3. UK Research Council's (EPSRC) Event Transforming Energy Demand through Digital Innovation (TEDDI)

Researchers from USTRAT attended a workshop on Transforming Energy Demand through Digital Innovation (TEDDI) in London, UK, on 15 June 2018. The workshop, organised by UK Engineering and Physical Sciences Research Council (EPSRC)-funded research network, TEDDINET, brought together researchers from academic institutions across the UK and EU, government, Energy Savings Trust and multiple external stakeholders. The latest research in digital technologies (smart meters, monitoring, automation and feedback) for enabling energy demand reduction and demand response was showcased and sandpits organized to map out research challenges for active consumer engagement, technology development and market deployment of these technologies. The value of the workshop was not only in exchanging research progress and lessons learnt during pilots from multiple projects in the UK within the TEDDI framework but also in finding mechanisms to help support policy development and decisions relating to digital innovation in homes and workplaces.

Besides disseminating Eco-bot with the workshop participants, valuable knowledge was gained on remaining research and innovation challenges to be tackled for active consumer engagement, technology development and market deployment. Valuable liaisons were also made with the Energy Savings Trust, Citizens Advice Bureau, the Building Research Establishment Group (BRE), and University of Surrey.

2.2.4. Liaisons with other EU and international projects

USTRAT, Dexma and Plegma staff attended the EU NILM 2017 Workshop in London, UK, on 6-7 November 2017, where Eco-bot goals were disseminated by USTRAT and DEXMA and more importantly, liaisons made with other businesses across the EU with NILM offerings. Gaps and trends were identified from these liaisons and talks at the workshop to better understand the market with respect to non-intrusive load monitoring (NILM) and help shape Eco-bot NILM offering.

USTRAT team visited University of Zilina, Slovakia, in Month 7 of the project and interacted with ERA Chair ERAdiate EC funded project on intelligent transport systems. The main lessons learned are related to integration of energy management and smart transport into smart buildings.

USTRAT gave a series of seminars on methods they developed for energy disaggregation at University of Sydney, University of Technology Sydney, University of New South Wales, Newcastle University, all in July 2018. Besides receiving useful feedback with respect to methodology development and datasets for low-rate NILM, USTRAT consortium members learnt more about ongoing research projects in Australia, including Australian Research Council-funded projects pertaining to smart grid communications, at University of Sydney, micro-grid research funded by Cotton RDC (Research Development Council) at University of Technology Sydney, Discovery Grant Project Power system security assessment given massive intermittent energy sources at University of New South Wales, Newcastle University and CSIRO (Commonwealth Scientific and Industrial Research Organisation) project on research pertaining to energy disaggregation for industry.

Besides disseminating Eco-bot findings, a valuable knowledge was gained on energy efficiency programmes, initiatives and trends in Australia, as well as on latest NILM development and implementation methods.

Estabanell and Dexma attended the Jornada Connect-EU 2017, held in Barcelona on November 6, 2017. The aim of the event was to inform companies and other R&D agents of the opportunities possible with H2020 projects. They also participated in the exposition space for European projects, where there was a stand dedicated to Eco-bot and where Estabanell and Dexma were able to discuss Eco-bot with participants of other European project representatives at the event, and to also learn about other project topics and issues.

In March 2017, Adelphi have had a brief exchange with Prof. Jasminko Novak, Managing Chairman at the European Institute for participatory media and member of the enCOMPASS project consortium that project concept similar to Eco-bot. enCOMPASS project focuses on the development of "innovative user-friendly digital tools for making energy data consumption available and understandable for the different users and stakeholders (residents, employees, pupils, building managers, utilities, ICT providers)". While in the Eco-bot project market segmentation was undertaken as part of WP 2, Prof. Novak explained that the enCOMPASS project did not foresee a segmentation of the market / the consumers. With regards to behavioural models, Prof. Novak stated that such a model will be applied for the system design of the app to be developed, similar to Eco-bot's approach. At the time of the telephone call, enCOMPASS did not have any publicly available deliverables, hence, details about specific project results could not be exchanged. However, concrete ideas for further exchange in the course of the two projects were discussed, including: promoting each other's projects through Twitter and participating in each other's workshops (and/or focus groups), if suitable.

2.3. Liaisons with governmental bodies and NGOs

2.3.1. Workshop with external focus groups and stakeholders

A workshop between (invited) major stakeholders in the area of energy efficiency and consumers behaviour and economics (coordinated with WP2) was organised in December 2017 in Granollers, Spain, to exchange knowledge and look for means of enhancing market potential. The workshop also aimed at bringing out important issues that need to be taken into consideration in the following steps of the project. The key external participants related to Eco-Bot's end users (representative from Estabanell Energia and Sud in the case of commercial clients), a speaker that can speak on a general legal level both European and Spanish from Catalan Energy Institute, and a Speaker that has hands-on experience with several energy efficiency projects from Diputacio de Barcelona, who combines this with experience in the public sector. The workshop was fruitful in establishing the needs of customers, the best way to engage with them, as well as considering the policy and legal framework implications. The workshop is described in detail in Deliverable 2.1.

2.3.2. Liaison with NGOs in Germany

Senercon introduced the Eco-bot project and the NILM technology at a workshop with co2online's management and staff representatives at co2online's premises in February 2018. Co2online is a non-for-profit company campaigning for energy efficiency in households and companies. Co2online maintains a network of 900 partners from industry, crafts, policy makers, energy and climate associations, banks and insurances. During the workshop, the application of Eco-bot within co2online's tools and projects was discussed as well as subjects that could initiate the Eco-bot dialogue with households. This was an important first step for defining the requirements of the Eco-bot chatbot during the Athens project meeting. Co2online was very interested in the innovative NILM technology as its application within co2online's tools would bring an important advance in comparison to competitors on the market of online energy monitoring tools.

2.4. Liaisons with external research organisations

Liaisons have been made by academics at USTRAT with the Centre for Energy Policy within the International Public Policy Institute at the University of Strathclyde. The Centre for Energy Policy informs and challenges the work of policy makers in energy and related areas. Through linkages with the Centre for Energy Policy, linkages with the International Energy Agency (IEA), headquartered in Paris were strengthened. The IEA works to ensure reliable, affordable and clean energy for its member countries and beyond. The focus of this new engagement is to leverage non-intrusive load monitoring and energy feedback

through smart meter analytics to influence economy-wide energy efficiency policies through macro-economic modelling.

Through these linkages, a researcher from Strathclyde attended an IEA Workshop on the multiple benefits of energy efficiency beyond energy savings in Paris in Month6. Valuable knowledge was gained on non-energy benefits of energy efficiency and evidence of environmental, economic and social development impacts beyond energy savings through case studies presented from across the world.

Liaisons have also been made with the InnoEnergy Master program SELECT (<http://www.innoenergy.com/education/master-school/our-master-programmes/msc-select-environmental-pathways-for-sustainable-energy-system/>), involving the universities UPC (Barcelona) and KTH (Stockholm), and the Swedish consultancy Sweco. As part of this collaboration, Estabanell gave a group of first year master students the Eco-bot case to develop their own project on top, proposing their own solution and analysis. Throughout the project development the students received guidance from Sweco, Estabanell Energia, and other parties collaborating with the program from all over Europe. Their input and approach proved to be interesting for the project itself and allowed the exploration of different approaches, questions, and views.

3. Summary of findings and recommendations

This section summarizes findings and lessons learned from the liaison activities described in Section 2 and provides recommendations for work ahead.

The interactions of consortium members with other, national, EU and international projects through activities described in Section 2, have positively impacted the Eco-bot technology development steps in multiple ways.

First, various non-intrusive load monitoring (NILM) methods were discussed and experience gathered from other projects. Based partly on these interactions and feedback received, the proposed Eco-bot NILM algorithm will be based on deep learning architecture, in particular, a combination of convolutional neural network and gated recurrent unit network, that emerged as the highest performing and most practical solution. Transfer learning has also been identified as the best option to avoid in-house training by using publicly available datasets.

Secondly, the liaison activities resulted in a more informed workshops to specify the bot requirements and customer engagement strategies. During the three first exploitation workshops under WP7 different exercises were offered. In the one of them participants identified needs and thoughts, or feelings of fictional, but typical customers of the three use

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cases (DEXMA, Estabanell and Senercon) through an empathy map towards their Eco-Bot experience. As “by-products” of these empathy maps some additional and nice-to-have features of Eco-Bot were deducted (and shared with the technical partners of the consortium).

Thirdly, liaisons were also beneficial in understanding success stories and potential pitfalls in field studies exploring user behaviour and engagement with respect to energy. Students in Estabanell and USTRAT have also had a chance to work on Eco-bot related problems to capture their views and approaches.

4. Conclusion

The report described various activities undertaken by the consortium members to make relevant liaisons with external bodies, such as stakeholders, governmental and non-governmental organisations, consumer bodies, research institutions, and other national, EU and international projects. The main goal of these activities was to exchange knowledge pertaining to energy efficiency measures and how to maximise impact of the Eco-bot outcomes, meeting national, EU and international energy goals. The lessons learned during these activities will be valuable in further development of technology, for example, improving energy disaggregation performance, improving software implementation, improvement bot functionality and user engagement while considering policy and legal framework.