This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957781.

Ref. Ares(2023)2349223 - 31/03/2023

active communities & energy
prosumers for the energy transition

GRANT AGREEMENT NUMBER 957781

WP7 – ACCEPT demonstration activities

D7.4 – Demonstration activity report from the Spanish pilot site v1

Responsible organisation	La Solar Energía
Contributing organisation(s)	Hypertech, CIRCE, SIN, QUE, CERTH, Witside, RINA-C, Mytilineos, MIWenergia, ESR, AEM, VIESGO, EEE
Due date of Deliverable	28/02/2023
Actual date of submission	31/03/2023
Type of deliverable	Report
Dissemination level	Public

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957781.

1

Authors

Name	Organisation	e-mail	Role
Antonio Soler	LaSolar	info@lasolarenergiacoop.es	Main Author
Pablo Barrachina	MIWenergia	pablo.barrachina@miwenergia.com	Contributor
Alejandro Andreu	MIWenergia	alejandro.andreu@miwenergia.com	Contributor
Ismini Dimitriadou	Hypertech	i.dimitriadou@hypertech.gr	Contributor
Georgia Roussou	Mytilineos	georgia.Roussou@protergia.gr	Contributor

Reviewers

Name	Organisation	e-mail
Riccardo Toffanin	AEM	rtoffanin@aemsa.ch
Arjen Schamhart	ESR	arjen.schamhart@energiesamenrivierenland.nl

Version history

Version	Date	Comments
0.1	13.03.2023	Table of Contents
0.2	14.03.2023	Report Drafting La Solar
0.3	20.03.2023	First Draft available for comments
0.4	23.03.2023	Review comments addressed
0.5	27.03.2023	Final draft for peer review
1.0	31.03.2023	Submission to the EC portal

Project Consortium

Austria
- European Center for Renewable Energy Güssing GmbH

Cyprus
- Witside International Markets LTD

Denmark
- Geco Global APS

Greece
- **Hypertech** (Project Coordinator)
- Ethniko Kentro Erevnas Kai Technologikis Anaptyxis
- Mytilinaios Anonimi Etaireia
- QUE Technologies Kefalaiiouchiki Etaireia

Ireland
- University College Cork
  National University of Ireland, Cork

Italy
- Rina Consulting SPA

Netherlands
- Bedrijfsbureau Energie Samen BV
- Cooperatief Energie Dienstenbedrijfs Rivierenland BA

Spain
- My Energia Oner SL
- La Solar Energia Sociedad Cooperativa
- Fundacion Undacion Circe Centre De Investigacion de Recursos Y Consumos Energeticos
- Viesgo Distribucion Electrica SL

Switzerland
- Azienda Elettrica Di Massagno SA

Contents

Table of Abbreviations and Acronyms

TD	Technical Director
PD	Pilot Director
COM	Commissioner
TEC	Technician
BoM	Bill of Materials
PV	Photovoltaic
DHW	Domestic Hot Water
HVAC	Heating, Ventilation and Air Conditioning
DR	Demand Response
EC	Energy Community
DH	District Heating Plant
EV	Electric Vehicle
DC	Direct Current
HES	Home Energy Storage
BIML	Building Information Management Layer
CGI	Common Gateway Interface
KPIs	Key Performance Indications
UC	Use Case
REC	Renewable Energy Communities
LEC	Local Energy Communities
P2P	Peer to peer
DSO	Distribution System Operator
C-App	Citizen mobile application
KPIs	Key Performance Indications

List of Figures

List of Tables

EXECUTIVE SUMMARY

This report presents the works conducted in Task 7.2 – Demonstration at the Murcia (ES) pilot site up to month 26 of ACCEPT project. It is the first report of the demonstration activities for this PS at Murcia

D7.4 details the Demonstration Plan for the Spanish PS and outlines the objectives for the Energy Community, some barriers still existing and the regulatory frame constrictions, and a plan for the UCs demonstration.

Presents the Use Cases to be tested in the Spanish pilot, introducing the Demonstration Plan for the activities to be performed for validation, detailing the test-bed for the ACCEPT solution operation and describes how the Uses Cases will be implemented.

Finally, remarks the support activities to assure the proper data collection and the procedures to solve the issues that could arise during the demonstration period. As deployment is finished at homes, main task in next weeks will be to ensure proper data collection and transmission.

Support activities will be provided to residents for installed sensors or meters in residential areas. Our support must help participants to understand how the solution works and how to interpret the data provided by the sensors and meters.

1. Introduction

1.1. Objectives and Scope of the Deliverable

This deliverable presents the work conducted under Task 7.2 as of month 26 of ACCEPT project. This task aims to describe all the activities carried out for the demonstration of the ACCEPT solution at the Spanish pilot site.

The main objectives of the deliverable can be summarised as follows:

- Describe the Community its objectives, as well as the regulatory framework and the constraints that affect the pilot site.
- Present the Use Cases to be tested in the Spanish pilot, introducing the Demonstration Plan for the activities to be performed for validation.
- Preparation of the test-bed for the ACCEPT solution operation, describing how the Uses Cases will be implemented.
- Describe the support activities to assure the proper data collection and the procedures to solve the issues that could arise during the demonstration period.
- Explain the foreseen actions to support and keep the engagement of the pilot participants.

The scope of this first version of the report covers the works performed since the start of the task, month 20, until month 26. This deliverable will be updated at month 33, with the first results of the demonstration activities. The outputs of these reports will be used to validate the ACCEPT solution, analyse the impact and explore the exploitation strategy.

1.2. Structure of the Deliverable

This deliverable is structured as follows:

- **Section 1:** Provides the main scope and objectives of Task 7.2, presents the structure of the report and the main section, and finally establishes the interdependencies with other tasks and deliverables.
- **Section 2:** Shows the Community objectives, presenting the ACCEPT Use Cases that will be tested in order to achieve the goals of the Pilot Site, as well as the regulatory framework and constraints that affect locally this Community. A description of the Demonstration Plan to be carried out for validation is presented.
- **Section 3:** Describes how to implement the different Use Cases and the activities that have been performed in order to get proper data from the IoT infrastructure deployed in the Pilot premises. Moreover, it explains the reasons behind the final Use Cases selected which differ from the ones included in D6.7.
- **Section 4:** This section explains the procedures to follow when a problem is encountered due to a failure in the communication between ACCEPT server and the smart devices installed at the users' dwellings.
- **Section 5:** the final section presents the next steps in the demonstration activities during the following seven months until the delivery of the second version of this report.

1.3. Interdependencies with Other Tasks and Deliverables

The main interdependencies of this Deliverable to Tasks and Deliverables of the same and other Work Packages can be summarized as:

D2.1: Use and Business Cases to be tested in each pilot site are described thoroughly in this deliverable. The responsible technical partners for each Use Case are also indicated.

D2.2: The Key Performance Indications (KPIs) and the datasheet for each KPI where the calculation methodology can be found, are detailed in this Deliverable.

D2.4: The system architecture description and a further description of the Use Cases is provided in this Deliverable.

D2.8: Report on innovative business models and service/contract design as well

D6.7: This deliverable provides a detailed description of the validation scenarios which will be tested in the Spanish pilot site and is strongly connected to the Demonstration activity report.

WP8: This work package assesses the impact of the ACCEPT solution on the demonstration sites and analyse the results of the demonstration activities to elaborate the business plan and define the exploitation.

D9.5: This deliverable develops the replication roadmap and the plan for scaling-up of the solution based on the real pilot results.

2. Demonstration Plan

2.1. Community objectives

La Solar is a renewable electricity cooperative that was born as a citizen initiative to foster the development of green energy and participate in the energy transition. Around 10 % of our Coop customers have a PV plant for self-consumption and many others are planning to install one or participate in multi-property renewable plants.

Figure 1. Pictures of PV installations from La Solar Coop. members

La Solar Energy Community is not in a single location but spread along a large territory, Region de Murcia and surroundings regions of south Valencia and east Andalucía, which may reach 2.000.000 inhabitants. Its 300 sunny days means a high potential for PV production, and consults from domestic users, enterprises and local authorities' have become normal.

Solar production has been increasing very strongly in the last two years powered by several European regulations, the energy price crisis and the Next Generation investments.

For those reasons, the interest from users in installing PV plants for self-consumption has increased largely among the more than 1.500 customers, moving our technical structure to fulfil those demands, investing resources in developing the first Renewable Energy Community (REC) with the tools at our hand (basically shared self-consumption at this moment), with the goal to develop a more complex model in next months as there are hopes that some process and figures will be approved by the Spanish Legislation.

A strength in our cooperative is the link with educational cooperatives. More than 20 of them are requiring the REC solution to engage teachers and administrative staff in a first level, and parents of students in a second stage. Thus, our growth potential is very high.

The Use Cases to be tested in the Spanish pilot site are shown in Table 1:

Table 1. The Use Cases to be tested in the Spanish pilot site related to the KPIs.

ID	Name	KPIs
UC1	Metering & Sensor Energy Data	SR-01, SR02, SR-03
UC2	Virtual Energy Storage optimisation	EC-03, ER-04, ER-08
UC3	Consumer demand-side flexibility forecasting	ER-03, ER-04, ER-05
UC4	Demand elasticity profiling-forecasting-aggregation	AE-05, MR-01, MR-02
UC7	Community-level P2P flexibility	EC-02, ER-01, ER-02
UC8	Participation in explicit Demand Response schemes	ER-07, AE-03
UC9	Participation in implicit Demand Response schemes	ER-07, AE-01, AE-02, AE-03
UC11	Retailer day-ahead optimal pricing configuration	MR-02, EC-01, EC-02
UC13	Increase self-consumption at local level	EC-03, ER-01, ER-02, ER-06
UC14	Active Citizen and LEC Engagement	AE-01, AE-02, AE-04, AE-06, BU-01, BU-02, BU-03

Considering our model of schools and its members as the social structure to create REC, the use cases selected are focused in covering the demands of service and profitability which may give stability to both participants and future business models.

Starting with a Renewable Energy Communities or Local Energy Communities (REC-LEC) active engagement process where final users are preselected among school community (UC14), collecting data to fix starting point (UC1), improving communication with users to give necessary tools to adapt consumptions and generate demand aggregations using day-ahead prices, demand response warnings (UC2, UC3, UC4, UC8, UC9), exchanging energy among participants (UC7) and promoting more local generation (UC13) will be covered by the selected UCs.

As our coop may develop retailer activities, UC11 is of great interest in order to define tariffs and commercial strategies which ensure economic viability.

2.2. Local Regulatory Framework and Constraints

Although regulatory framework does affect us in a limitative way, our partnership in ACCEPT has given us the chance to push the idea of REC as a future at reach.

The Spanish Regulatory Framework that affects the electricity market and the Energy Communities (EC) can be shown below:

- The Spanish Electricity Sector Act 24/2013 of 26 December, which regulates the electrical sector.
- Royal Decree 244/2019 that regulates self-consumption.
- Royal Decree-Law 23/2020, that define the figure of Renewable Energy Community.

During the last few years, there have been several changes and updates on the legislation to facilitate the integration of renewable energies, mainly PV plants. The most important milestone was the approval of RD

244/2019, that allows the citizen to inject on the electricity grid their electrical surplus, but not only for one owner but also enables multi-property renewable plants where all participants can take advantage of the PV production.

Surplus kWh is paid at a fixed price or usually wholesale price depending on the agreement with the retailer, but usually wholesale price

Although the Royal Decree-Law 23/2020 defines for the first time the figure of Renewable Energy Community, however the current Spanish policy framework has yet to fully develop the European Regulation (EU) 2019/943 that will allow small/medium users to participate actively in the energy market as prosumers.

Nevertheless, these improvements on the legislation, the launch of funds from the Next Generation EU to create Energy Communities and Community Transformation Offices to support their implementation along with additional changes such as the increase on the distance from the PV plant up to 2 km, that permits any user to be part of the multi-property plants, is helping the growth of ECs in Spain.

The main barriers that an EC faces in Spain are listed here:

- Regulatory constraints for self-consumption, still there are distance limitations to be part of a multi-property PV plant, although it has improved with latest legislation changes, 2 km.
- Energy communities are not legal figures, they must be either an energy Cooperative or an Association.
- Bureaucracy takes a lot of time since the project to implement the PV is made until being able to inject the energy surplus to the grid, moreover for multi-property plants. DSOs delay the connection of the plants.
- The feeling of frustration when willing to install PV as legislation is a huge barrier for small/medium consumers.

Another constraint that can be found is the lack of business models as there are not flexibility programs for small/medium consumers, aggravated by the fact that the figure of aggregator has not been fully developed in the Spanish legislation. Currently, to participate in the electricity market as a flexibility asset, a minimum of 1MW of power capacity is needed, which limits the possible participants.

Regarding demand response (DR), as explained above, there's no explicit DR programs for small/medium consumers, but as a dynamic tariff (one price for each hour according to the Wholesale Market price) is available for any consumer, implicit DR signals can be used to obtain costs savings. Also, the Spanish tariff structure is divided in three periods for all consumers (with < 15 kw of power contracted), in order to foster the shift of energy between high cost hours to low cost periods. However, the energy crisis has increased largely the electricity costs and the largest utilities (related with the main DSOs) have offered fix-tariffs with prices below the Wholesale Market price that disincentivise users to shift consumption.

This fact is turning in last 3 months (winter 2022-23) to a more logical price market and dynamic tariffs are recovering its profitability.

All ACCEPT participants are expected to use hourly dynamic tariffs to incentive demand response so they can benefit the most from ACCEPT project. **The participation in UC8 is planned via simulation with a Virtual DSO (to be determined who is going to simulate the signals)**

2.3. Description of the Demonstration Plan

The timetable for the implementation of the different Use Cases can be observed in Table 2. There, the responsible partners for the development of each UC are also specified. Some of the UCs will start once the ACCEPT platform and all of their components are implemented and fully integrated, even before the users and pilot managers have access to the ACCEPT tools.

UC14 which is related to user engagement works differently to the rest of UCs, as the living labs activities started at the beginning of the project with T3.1 and continue later with T7.1.

End-users will be approached when the C-App is available. At a first stage, with a preliminary version with only monitoring functionalities, which is expected to be available by M28. The C-App version with full functionality will be accessible at the end of M29. Workshops and training sessions will be organized in order to ensure that the tool is properly understood by the Spanish participants and to foster their participation.

Table 2 Expected started time for UC testing

ID	UC Name	Responsible Partners	Expected starting time			
			M27	M28	M29	Comments
UC1	Metering & Sensor Energy Data	QUE/CERTH		█		Monitoring functionalities of the C-App will be available for end-users.
UC2	Virtual Energy Storage optimisation	HYPERTECH/ QUE		█		For the Spanish pilot, since the necessary IoT infrastructure is now in place, and the Building Asset Manager component is available and integrated with the BIML, the self-consumption VES optimisation UC can start being tested from April 2023 onwards.
UC3	Consumer demand-side flexibility forecasting	HYPERTECH/ QUE	█			For the Spanish pilot, since the necessary IoT infrastructure is now in place, and the Building Asset Manager component is available and integrated with the BIML, the specific UC can start being tested from April 2023 onwards.
UC4	Demand elasticity profiling-forecasting-aggregation	WITSIDE/ CIRCE				TBD
UC7	Community-level P2P flexibility	QUE/ HYPERTECH			█	
UC8	Participation in explicit Demand Response schemes	CERTH/ HYPERTECH			█	Explicit demand response schemes can start being implemented once the finalisation of the C-App (where relevant notifications are sent) is completed, i.e., around May 2023.
UC9	Participation in implicit Demand Response schemes	CERTH/ HYPERTECH		█		Cost-optimisation scenarios have been used to validate the BAM using timeseries pricing data from Spain. The UC can be implemented from April 2023 onwards.
UC11	Retailer day-ahead optimal	WITSIDE/ CIRCE				TBD

ID	UC Name	Responsible Partners	Expected starting time			
			M27	M28	M29	Comments
	pricing configuration					
UC13	Increase self-consumption at local level	HYPERTECH/ CERTH				The refinement of the Energy Community Tools (and their finalisation) is currently underway. By May 2023, once the ECTs have been finalised and fully integrated with the ACCEPT solution, tests on community-level self-consumption can begin.
UC14	Active Citizen and LEC Engagement	SIN/ UCC				Continuous evaluation

In comparison to the UCs that were mentioned in D6.7, there are two extra ones that have been added for the Spanish pilot site. UC2, Virtual Energy Storage optimisation and UC7, Community-level P2P flexibility. In the first one, DHW tanks and HVAC units will be used as virtual storage units for thermal energy, therefore, this UC can be applied in the Spanish users. The second one will be tested virtually because P2P flexibility cannot be applied with the current Spanish Legislation, however it's expected to be implemented in a short period and it's a fundamental tool for the Spanish EC to share the benefits of the energy surplus from their PV plants among the members of the EC.

3. Preparation of the Pilot Test-Bed

In order to test the UCs, different sensors were deployed at the users' premises, as a result of the activities of T6.1, T6.5 and T6.6. This deployment was explained in D6.7 of the ACCEPT project. During this deployment the connectivity between the smartbox/gateway installed at the user's dwelling and the ACCEPT server was checked and approved by the technical team from Hypertech. The commissioner made sure that consumption and ambient data was sent to the smartbox properly and also the control devices were tested with the remote support of the technical team.

The UC will be tested following the procedure explained in table 3:

Table 3. Procedures to test each UC

ID	UC Name	How UC is going to be tested
UC1	Metering & Sensor Energy Data	After the integration of all components is complete, visualization of the values from all smart devices will be shown in the C-App and Community tool.
UC2	Virtual Energy Storage optimisation	The BIML will communicate with ACCEPT solution for the optimisation of the energy consumption.
UC3	Consumer demand-side flexibility forecasting	The On-Demand Flexibility Manager with inputs from the Building Digital Twin model will provide the prosumer-level forecasting.

UC4	Demand elasticity profiling-forecasting-aggregation	Demand price forecasting has been made with real data for the Spanish energy mix, then the model will be train with the BIML end-point data from the pilot users and the energy price from the wholesale market to obtain the elasticity.
UC7	Community-level P2P flexibility	This UC will be simulated as it is not possible due to current regulation. This UC will study the benefits that can be achieved by sharing the surplus production within the members of the EC.
UC8	Participation in explicit Demand Response schemes	Notification will be sent to end-users through the C-App. End-users will receive points and rewards for each event.
UC9	Participation in implicit Demand Response schemes	Once all modules of the ACCEPT solution are fully integrated, implicit DR will be activated sending automatic signals to the smart devices to obtain cost savings shifting consumption from expensive hours to cheap hours. Users will be informed and can override the implicit DR action but do not need to accept the signal for its implementation.
UC11	Retailer day-ahead optimal pricing configuration	TBD by WITSIDE/ CIRCE
UC13	Increase self-consumption at local level	The Energy Community Tools will receive for all applicable prosumers (the ones that belong in the Spanish energy community) the various trained models (i.e., DER models, building thermal, occupancy, etc.) from the prosumers' BAM and perform the necessary community-level self-consumption optimisation. The output of this optimisation will be the operating schedules for the different prosumers, which will be send via the BAM to the BIML of each household.
UC14	Active Citizen and LEC Engagement	Questionnaires and surveys will be sent to end-users and workshops will be organised to explain the ACCEPT tools, maintain the engagement and get feedback.

Maintaining the communication between ACCEPT system and the smartboxes and sensors is of vital importance to be able to implement the UCs. For that reason, an online monitoring tool has been created by Hypertech with access to all responsible parties from the pilot site: the pilot director, the commissioner and the technician, where the status of the different devices can be checked. In this Google document, the following information can be found: user ID, summary if the status of the devices, status of each kind of sensor and equipment, comparison with the deployment plan, correctness of date, ghost data, comments from the technical team and the pilot managers, and the date of last change. This tool will be updated weekly and will facilitate a quick response to any issue that can arise at the user's premises.
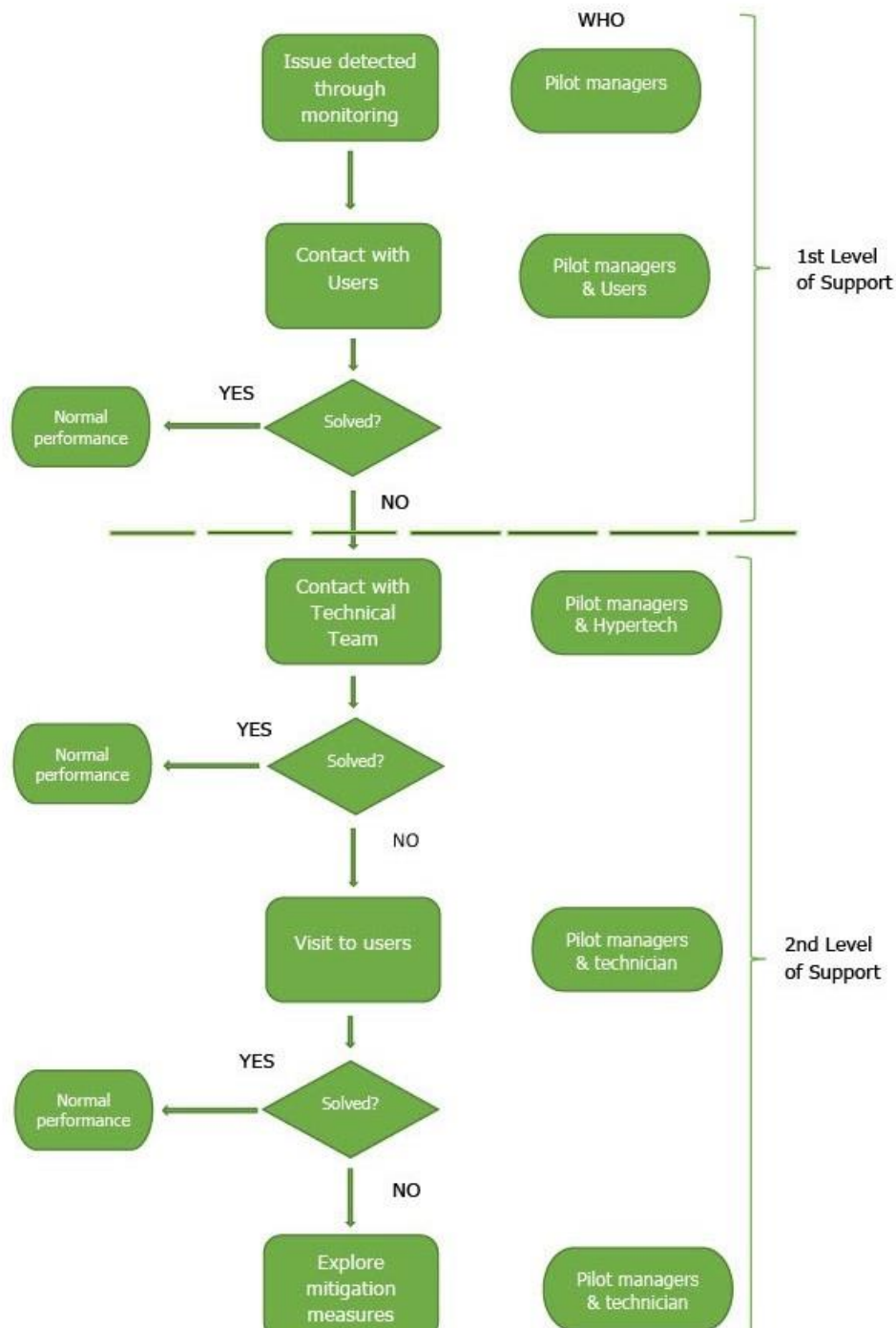
Figure 2. "Screenshot of the monitoring tool"

ACESR	Monitor	Raspberry Status	Meters Status	Sensors Status	Actuators (Intesis/FIBARO) Status	Comparison with the Deployment Plan	Correctness of data	Ghost Loads	General Comments	MIW comments	Date of last change
ACESR01	4/4	ONLINE	Shelly EM + 50A Clamp (Main meter): ONLINE/ Shelly EM + 50A Clamp(PV): ONLINE/ Qubino Smart Plug 16A (DHW): ONLINE	N/A	N/A	ok	Shelly EM + 50A Clamp(PV): Production during night hours		Actions to take:(i) Identify on site why PV production values occur during night hours	According to our last telco. Is it really needed the visit on site?	3/10/2023
ACESR02	3/3	ONLINE	Shelly EM + 50A Clamp (Main meter): ONLINE Qubino Smart Plug 16A (DHW): ONLINE	N/A	N/A	ok	ok				3/10/2023

4. Support activities

When an issue is detected a procedure for troubleshooting has been established as shown in the flow diagram (figure 2) below. If there is a problem with a smart device, the pilot managers start the first level of support when the user is contacted and they try to solve the issue resetting the smartbox or reconnecting the faulty devices. If the issue persists, then the second level of support is activated, when the pilot managers contact the technical team from Hypertech and check if it can be solved with their support, otherwise, a new visit to the user's dwelling is needed to restore the system. In the case that it can't be restored, mitigation actions will be explored.

Users can contact directly the pilot leader in case of problem.

Figure 3. "Flow diagram when an issue is detected"

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957781.

14

5. Next Steps

As explained in the Demonstration plan, section 2.3, the tests and validation of the UCs will start in March '23 (M27) and will continue until M40. Once the C-App and Community App are available for end-users and pilot managers, demo partners will monitor the implementation and performance of the UCs, and will validate the results with the support of the UC responsible partners. Furthermore, a follow-up of the status of the IoT infrastructure deployed in the Spanish pilot will be performed through the monitoring tool, the first and second levels of support to maintain the data communication.

So, main objectives will be:

- ensure that mistakes in transmission of data are identified and solved.

- discuss the implementation of UCs with partners at first stage and participants in a second stage.

- complete definition of when and how the UCs will be tested with partners at first stage and participants in a second stage.

Regular meetings will be done with the other demo partners to share experiences and issues, in order to improve the performance of the pilot activities and tests.

The activities carried out for the next 7 months will be included in the second version of this report, taking special attention to all support and engagement activities performed with the end-users to keep them involved with ACCEPT project.