



Horizon 2020 – LCE-2017 - SGS

## **FLEXCoop**

Democratizing energy markets through the introduction of innovative flexibility-based demand response tools and novel business and market models for energy cooperatives

### **WP7 – System Validation and Impact Assessment**



## **D7.1 – FLEXCoop System Deployment Plan in Pilot Sites**

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## EXECUTIVE SUMMARY

The present deliverable is the first outcome of Task 7.2. “System Deployment in Pilot Sites”. This task also includes two more deliverables that will be directly impacted by D7.1, and will be submitted respectively in the first phase of Task 7.2 (Month 14 to 26): D7.3. “Report on FLEXCoop Framework deployment at Pilot Sites –Preliminary Version”, and in the second phase of Task 7.2 (Month 30 to 33): D7.6. “Report on FLEXCoop Framework deployment at Pilot Sites –Final Version”. The scope of D7.1 is to define the FLEXCoop Deployment Plan of all the necessary equipment to be installed in both FLEXCoop pilot sites (Spain and The Netherlands), as well as to define the initial deployment roadmap for its integration with the existing components and systems.

The FLEXCoop System Deployment Plan is mostly guided by D2.5 (corresponding to Task 2.4) - regarding the Performance, Measurement and Verification (PMV) Methodology, and D4.1 (corresponding to Task 4.1) -regarding the Open Smart Box (OSB) Prototype Design. Furthermore, D7.1 is also guided by D3.3 regarding the Heating, Ventilation, and Air Conditioning (HVAC) and water-heating system monitoring and control.

This document aims to report the plan to be followed by the pilot sites to run the installation activities that will take place from Month 14 to 33 of the project activities (Task T7.2). The validation activities of the project (Task 7.1) started one month before Task 7.2 and finish at M22, before the first phase of the system deployment in pilot sites. To this end, at D7.2 “FLEXCoop Evaluation Framework and Respective Validation Scenarios”, the monitoring of pilot validation activities is carefully planned, including validation scenarios, based on an evaluation framework and impact assessment of the FLEXCoop project. From Month 26 to 35, the pilot roll-out phase will take place based on the deployment of the FLEXCoop system at pilot sites (Task T7.4).

The detailed integration, testing and monitoring plan activities will be delivered in T6.4. The detailed plans for the installation tasks in each pilot site, the equipment description and the system configuration will be delivered in the next version of the FLEXCoop system deployment at pilot sites (D7.3).

This deliverable is structured as follows:

- Section 2 presents the pilot planning schema and time plan for the installation process
- Section 3 details the initial trial FLEXCoop installation in friendly users’ dwellings, including the description of the detailed pilot surveys from friendly users.
- Section 4 describes the criteria for the selection of pilot participants (divided in pilot users and pilot cooperatives) and the collection of pilot surveys in both pilot sites with the required detailed equipment of their dwellings.
- Section 5 explains the installation plan, the assigned roles in the installation process, the installation guideline of the FLEXCoop equipment, as well as the activities to carry out in the pilot dwellings, finalising with the testing and monitoring processes.
- Section 6 provides the bill of materials of friendly users for the preliminary FLEXCoop equipment installation description.

Finally, conclusions are summarised in Section 7, followed by section 8 (references) and 9 (annexes).

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**ABBREVIATIONS**

D	Deliverable
DER	Distributed Energy Resources
DHW	Domestic Hot Water
DR	Demand Response
DSO	Distribution System Operator
EC	European Commission
EU	European Union
EV	Electric Vehicles
H2020	Horizon 2020 Programme
HVAC	Heating, Ventilation, and Air Conditioning
KPIs	Key Performance Indicators
M	Month
OS	Open Source
OSB	Open Smart Box
PMV	Performance, Measurement and Verification
PU	Public
PV	Photovoltaic panels
R	Report
RIA	Research and Innovation Action
VPN	Virtual Private Network
VPP	Virtual Power Plant

## 1. INTRODUCTION

The FLEXCoop project pivots towards a more sustainable energy mix based on demand response rather than generation response by using cutting edge technologies at home. FLEXCoop aims to empower domestic end user participation in electricity markets and grid stability. To this end, the FLEXCoop project aims to provide an end-to-end interoperable solution for a Demand Response optimisation framework, which includes a fully-fledged tool suite for energy cooperatives and prosumers.

The installation of the FLEXCoop solution in the two pilot sites of the project needs a detailed pilot planning as a follow-up guide with established timeframes to proceed with the installation process. This deliverable describes the pilot deployment plan/pilot planning, which designs the steps and actions to be carried out in each selected pilot dwelling during the deployment rollout. Those actions will be continuously be monitored and controlled to ensure a smooth installation process and afterwards a successful demonstration of FLEXCoop results in the pilot sites.

First, a complete trial installation of the FLEXCoop solution was performed in three friendly users' dwellings from both cooperatives. The trial installation is of high importance since it confirms the functioning of an early version of the Open Smart Box (OSB) and the off-the-self equipment in the live environment. The installation plan was similar and simpler than the one to be carry out in the rest of dwellings from pilot participants in the project. In order to install the new equipment, a set of requirements was created for the selection of pilot users from the Spanish and Dutch cooperatives. According to the FLEXCoop scope, there will be at least 20 pilot users to demonstrate FLEXCoop tools. Therefore, the agreement clause about participating in fully automated control strategies in a Demand Response (DR) event is remarkable and a pre-requisite for an end-user to be selected and participate in the demonstration phase of the project.

The selected equipment to be installed in the pilot dwellings and the installation plan are part of the first version of the deployment plan, concluding with the integration plan of the FLEXCoop equipment.

## 2. PILOT PLANNING

The pilot planning determines, in detail the installation time plan, selected pilot participants and activities in pilot sites, FLEXCoop equipment guidelines to installers, and description of FLEXCoop equipment to install, assignment of roles and responsibilities in the installation process, description of all installation procedures and testing, and finally the integration of the FLEXCoop equipment with existing installed devices.

The pilot planning, illustrated in Figure 1, has a total duration of 17 months and it comprises three main phases:

1. The initial trial FLEXCoop installation in friendly users' dwellings (three users in total).

This phase has a duration of 11 months, from M9 to M20 (13/06/2018 - 24/05/2019). The initial trial FLEXCoop installation consists in collecting data for the baseline and running the early OSB version. Initially, this phase required the collection of detailed pilot surveys about the existing equipment and characteristics of the dwellings of three friendly users from the two pilot sites. The bill of materials and ordering of sensors continue as a second step, to finalise with the complete installation of FLEXCoop sensors and preliminary OSB version, delivered at M13 before schedule (See section 4 of D4.1). See Section 3 for detailed information.

2. The selection of pilot users from the two cooperatives in Spain and the Netherlands.

This phase has a duration of 5 months, from M12 to M17 (13/09/2018 - 06/02/2019). It consists in the selection of pilot participants from both pilot sites, collection of consent forms and detailed pilot surveys existing equipment and characteristics of their dwellings. See Section 4 for detailed information.

3. The FLEXCoop installation plan in selected dwellings from pilot users.

This phase has a duration of 9 months, from M17 to M26 (07/02 - 18/11/2019). This phase includes the creation of the list of materials and ordering of equipment, installation of FLEXCoop sensors and early version of OSB. It also includes OSB software upgrades, full functioning and testing of all the in-home equipment installed. See Section 5 for detailed information about the installation plan.

The integration plan of the FLEXCoop system with existing devices will be defined in T6.4, with the collaboration of the technical partners from the consortium. The integration of FLEXCoop components, preliminary testing, and pre-pilot validation is divided in two phases: the first one that lasts 9 months, from M18 to M25 (01/03 - 18/10/2019); and the second one that lasts 4 months, from M29 to M32 (01/02 - 01/05/2020).

After this deployment plan, the OSB full demonstration (delivered in D4.6) and the pilot roll-out and demonstration of the FLEXCoop solution (delivered in T7.4) will start in M26 (November 2019), lasting 10 months until M35 (August 2020), which is the timeframe of the complete delivery of the final FLEXCoop solution.



According to the Performance, Measurement and Verification (PMV) methodology defined in FLEXCoop D2.5, the FLEXCoop models will provide a continuously auto-calibrated baseline that uses data from the minimum number of recent days needed to obtain a high accuracy. There will be automated DR flexibility events performed during this period. Although the DR events will be automated-controlled, participants will have options to opt out temperature or other comfort categories' preferences. Feedback from participants will be gathered via questionnaire or participation in workshops/living labs.

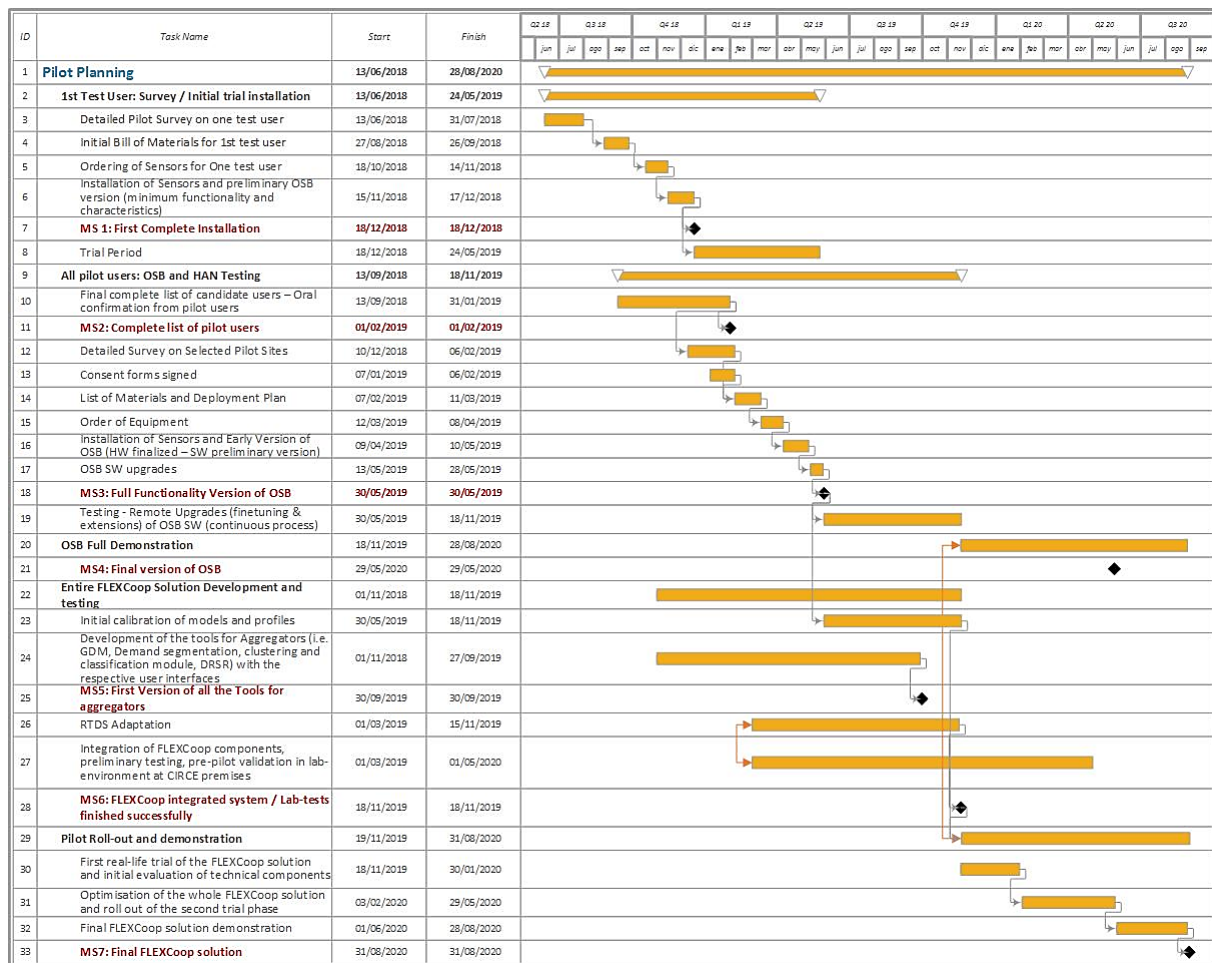


Figure 1: FLEXCoop Pilot Planning

### 3. INITIAL TRIAL FLEXCOOP INSTALLATION

As aforementioned, the first phase of the pilot planning is the initial trial installation of the FLEXCoop components in dwellings of three end-users (two users from the Dutch pilot site, and one user from the Spanish pilot site). This phase is key in the FLEXCoop installation since it proves the functioning of an early version of OSB and the off-the-self equipment in a real environment, thus serving as a detector of possible problems to be solved before the FLEXCoop installation in the dwellings of the rest selected pilot end-users. As stated in section 2, the trial installation aims to collect data for the baseline and to run the early OSB version.

The timeline for the trial installation period is shown in Figure 2. Firstly, pilot survey templates (See Annex 9.1) were elaborated to afterwards be circulated among the three friendly users that the cooperatives selected. Once the information from their dwellings were collected, the next procedure was to generate the bill of materials to buy in order to enable the deployment the FLEXCoop solution (the bill of materials is attached in Section 6.1 and 6.2). The cooperatives bought the needed materials from the list and their installation, at M14 (November 2018). The OSB early version was delivered to the users one month before (M13). Finally, the trial period rollout lasts 5 months: from M15 to M20 (December 2018 to May 2019).

Action	Deadline	Month/year
Detailed Pilot Survey on one test user (one pilot site)	M10	July 2018
Initial Bill of Materials for 1st test user	M12	September 2018
Ordering of Sensors for One test user	M14	November 2018
Installation of Sensors and preliminary OSB (minimum functionality)	M15	December 2018
Trial Period	M15-M20	December 2018 - May 2019

Figure 2: Trial period timeline

### 3.1. Pilot survey results of friendly users

#### 3.1.1. Spanish friendly user

The friendly end-user in the Spanish pilot site has a high rate of engagement with the project objectives. Moreover, our friendly end-user is a computer technician, which entails an added value to the first trial, as long as he is fully comfortable with the usage of new technologies and he can provide valuable feedback to the project. Additionally, it is planned that the friendly user is going to participate in the first workshop (end of January 2019) with the other end-users in order to provide feedback about the user experience (see section 4.2.4 for detailed information).

The dwelling is a detached household in a city of Olot (North-East Spain). The characteristics of the dwelling are described in Table 1. Due to technical reasons, the FLEXCoop solution will be focused on the heating system and the DHW, but not on lightening.

This dwelling has a peculiarity: the detached house next to the friendly user home is owned also by his family. Both houses have a single electricity contract, so a single smart meter. The technical partners know this information and it is not an impediment for the FLEXCoop solution, as long as FLEXCoop is not using the data coming from the smart meter. The FLEXCoop solution is gathering the consumption data with extra meters in order to get this data in a real time frame.

The OSB and the additional devices have been installed the December 2018 by an installation cooperative. This company will be the same company that will perform the other end-user installations. So, by end of January 2019 they had already the first experiences with the FLEXCoop solution. Our friendly end-user reports that any issue has come out due to the installation and they haven't detected any discomfort since the installation.

Spanish Friendly user dwelling location		Olot (North-East Spain)
Number of inhabitants		2
Dwelling size (m <sup>2</sup> )		150-200
Average annual consumption (kWh)		8000
Existing Equipment		Main heating system: Heat pump DHW: electric boiler No PV, no battery No EV No lightening
Installation of FLEXCoop solution	14/12/2018	By Installation cooperative

Table 1: Spanish Friendly user dwelling characteristics

### 3.1.2. Dutch friendly users

Two friendly users in the Netherlands are participating in the FLEXCoop project. The friendly users are also responsible for recruiting the other pilot users in the Netherlands. So the experience they will have by being the friendly users can be used to inform other pilot users by first-hand about what the FLEXCoop project is and what it really is to be a user.

Both pilot users have detached dwellings. One is in the centre of the Netherlands and the other is in the East part of the Netherlands. In the East we will also have all the other pilot users. Both dwellings have smart meters. The FLEXCoop solution is gathering the consumption data with extra meters in order to get and collect this data in real time.

Both cooperatives from the Dutch pilot site (ODE Decentraal and Escozon) participated in the elaboration and delivery of the detailed survey template (See Annex 9.1). Based on the results a material list was created by Hypertech. The material was ordered by ODE Decentraal.

Lighting will be controlled by the FLEXCoop solution in the living rooms of both houses. Both houses also have solar panels. In one house, the production of the solar panels will be collected directly from the converter. In the other house, an additional electric meter will collect the production data.

There was an initial intention to also manage the DHW tanks in one of the pilot users. The material list also contains equipment to manage the DHW tank. The DHW tank is pre-heated by a solar panel. But when there is not enough heat available the tank is then heated by gas. Because of this dual-heating and after some further study FLEXCoop concluded that this was not a useful case. So it was decided to skip this.

In the house in the Centre of the Netherlands, the friendly user installed the FLEXCoop equipment himself. This was done to get the experience on do-it-yourself installation of the FLEXCoop equipment. The equipment is completely installed and running since half of January 2019. In the second house in the east, the installation is ongoing and is done by an installation company. The same installation company will also install the FLEXCoop equipment in the houses of the other pilot users.

Dutch Friendly user dwelling location	Centre of the Netherlands		East of the Netherlands	
Number of inhabitants	3		4	
Dwelling size (m <sup>2</sup> )	>250		>250	
Average annual consumption (kWh)	12766		6000	
Annual RES production (kWh/year)	2.700		5000	
Existing Equipment	Gas heating. No heat pump or electric HVAC  PV, production data collected by a converter  No RES storage battery, EV  Lightening control in living room		Central Gas heating  PV, production data collected by an additional electric meter.  RES storage battery, EV  Lightening control in living room	
Installation of FLEXCoop solution	14/01/2019	Do-it-yourself Installation	14/02/2019	By Installation company

Table 2: Dutch Friendly users' dwelling characteristics

## 4. PILOT USERS SELECTION

### 4.1. Pilot users

#### 4.1.1. Mandatory requirements

- Domestic end users with permanent residence in a dwelling of this own property, at least for the following 3 years, and with no ethical or other concerns about participating in an European Union (EU) Research & Innovation Action (RIA) project.
- Active electricity consumer with a supply contract in force.
- Active member of any Living Lab Pilot cooperative. One (or two) Cooperative to be selected in the Netherlands and Som Energia for Spain.
- Residential users with electricity Heating, Ventilation, and Air Conditioning (HVAC) as electric radiators and heat pump, and water heater as the main heating system at home.

- Residential users willing to participate in the project for 2 years and sign a consent letter to permit the installation of sensors, OSB and additional devices (e.g. hardware controllers, actuators, smart lamps) for remote monitoring and control of the associated controllable devices (HVAC, water heater, lighting), and give feedback about the user experience.
- Residential users that are fine with the approach of having a semi-automated framework (home automation by giving the option to end users to opt-out from a control strategy) in premises.

#### *4.1.2. Additional non-mandatory requirements*

In addition, there are a number of “wants”, that are not mandatory but good to have in order to maximise the testing opportunities and results of demand flexibility of domestic users:

- Residential users in the same geographical area to facilitate installation and maintenance of the OSB, sensors and systems installed.
- Residential users with high electricity consumption (>3500 KWh/year) to maximise demand flexibility targets.
- Residential users with high number of smart, controllable devices, such as smart HVAC and DHW and dimmable lighting (e.g. Philips Hue)
- Residential users with self-consumption capacity, by means of their own photovoltaic or generation systems (checking the potential of integrating with PV units)
- Residential users with energy storage capacity like EV vehicles, large batteries and large hot water tanks.
- Residential users with a bit of knowledge of the way to save and use energy, the concept of smart grids etc.

#### *4.1.3. Commitments*

The pilot user participation in the 2 years of piloting will mainly bind them to do or consent the following actuations.

- Share data about dwelling characteristics, Distributed Energy Resources (DER) profile, comfort preferences, daily schedules, and actual historical electricity consumptions for a previous characterization of their consumption patterns. Some of the data will be gathered through questionnaires (e.g. dwelling characteristics) but most of them will be available through the raw data gathered by OSB. Data sharing will be protected by non-disclosure agreements.
- Allow access to their premises to project members and subcontracted installing companies, at least once to install sensors in the beginning, as well as for other maintenance or problem fixing activities. The FLEXCoop partner Grindrop is delivering the OSB which will be installed in the first installation (together with other devices) and updated remotely. Minimum disruption for the end users will be observed and the users will have always the

option to opt out from an automated control strategy. Shut down of the system will be enabled.

- Provide high level maintenance of the system, especially in the beginning we would like to have some hands-on support from the end user (if the system is working, etc.). It is better to have tech savvy people enrolled in the project; users that are willing to understand the way the OSB device work (minimum requirement from their side is to be able to reboot the system and check the connection with the internet).
- Understand the concept of the project and participate in DR campaigns examined in the project.
- Willing to participate in the market place established in the project towards offering their DR flexibility to different Aggregators.
- Provide occasional feedback about the services provided by FLEXCoop, the status of the installed devices, and the user experience. User experience is designed in such a way that does not require their active intervention by end users, and should not affect their comfort preferences. Feedback will be gathered via questionnaires.

#### *4.1.4. Benefits*

- At the end of the project they can keep the installed OSB and devices. In addition, OSB will host some light version of software to support the usage of the OSB even after the end of the project (with no connectivity to the rest of FLEXCoop systems)
- Gain a high knowledge of their consumption profiles and be able to reduce them or take part in implicit demand response to reduce their electricity bills. This will not explicitly supported after the end of the project; partial support will be examined via the lightweight version of the software running in OSB.
- Get expert advice and feedback about possible behavioural changes towards a higher energy efficiency at home. A consumer app will be available during the project period to provide insights and messages to the end users.
- Contribute to a European Commission (EC) founded Research and Innovation Action (RIA) project that works to empower domestic end user participation in electricity markets and grid stability.
- Contribute to an EC founded RIA project that works towards a more sustainable energy mix based on demand response rather than generation response by using cutting edge technologies at home.
- Participate together with the energy cooperatives as aggregators in the balancing of your own local grid in a sustainable and transparent way. It is up to the Cooperative to check the way to reward the users (the Aggregator services will support reward functionalities).
- The participants will get a report at the end of the project related to their consumption patterns, improvements on this pattern, recommendations, and the overall contribution in the project.

## 4.2. Pilot Cooperative

### 4.2.1. Mandatory requirements

- All Pilot Users are member of the Pilot Cooperative
- The cooperative needs to work with the software solution.
- They need to have a key user which has knowledge of the total solution.

### 4.2.2. Additional non-mandatory requirements

- Sells the flexibility to the market and needs to have a contract in place.
- Needs to work together with an Energy Supplier or Distribution System Operator (DSO).
- No needs to have a system in place to pay for the flexibility of the pilot users; ideally to provide requirements for the design of the system which is part of FLEXCoop development.

### 4.2.3. Commitments

- They need to have a key user which has knowledge of the total solution.
- The key user will understand the concept of the project and inform the consortium in case of malfunction.
- The key user will partially check the platform and perform testing of the functionalities offered by the solution, namely:
  - An analytics engine to perform analysis over historical data and Virtual Power Plant (VPP) formation/ definition of assets that best fit to specific DR strategies
  - Real time monitoring of portfolio status
  - Demand Respond (DR) strategies implementation (real time)
  - Remuneration of citizens for participation in DR campaigns.
  - Access on a DER registry and marketplace for setting contracts with customers willing to offer DR flexibility
- Provide occasional feedback about the services provided by FLEXCoop, the status of the software, and the user experience. User experience is designed in such a way that does not require excess usage of the system. Feedback will be gathered via questionnaires.
- The pilot partners will need to keep in contact with the pilot cooperatives every month (short call to gather some feedback).

### 4.2.4. Pilot site activities

Other possible actions in which Pilot users and Cooperatives might get involved during the project concerns the participation in workshops about FLEXCoop project activities, and other project activities.

For end-users:

- Workshop(s) will take place at the deployment of the software (one or two workshop in each pilot site in February-March 2019)
- Additional workshop could take place at the deployment of the Prosumer/Aggregator Application (October 2019)
- Workshop will take place for the final evaluation towards September 2020.

For cooperatives:

- Activities will take place at the EU level in the form of living labs workshops in order to reflect on business models for cooperatives (Q4 2019).

The timeline below summarises the main planned workshops:

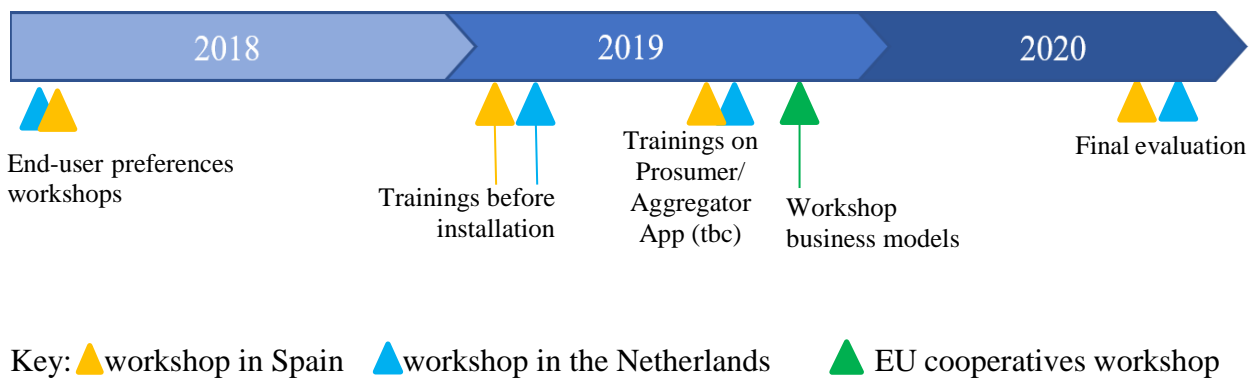


Figure 3: Timeline of workshop activities for end-users and cooperatives

The first training workshop will take place at the time of the FLEXCoop tools deployment. It would address the following key aspects:

- Intro to the project
- Presentation of the tools
- Installation process
- Functioning of FLEXCoop solution and main steps over pilot duration
- Liability and Data privacy approaches
- Signature of consent forms

### 4.3. Spanish Pilot site

During September and October 2018, we have been collecting possible end-users for their participation in the project. In order to engage Som Energia cooperative members we have disseminated the call for participants throughout two paths: (1) mailing to the local groups of the cooperatives (where the most active members gather) and (2) a Facebook post [1]. Both



paths have been restricted just to the area of interest, with the objective to get possible participants from the same area and close to the main office.

With the aim to provide to the project the candidates who best fit with the requirements, and in order to gather the information needed for the best participant selection, we have designed a short questionnaire [2]. The questionnaire was distributed through the mail to the local groups and the Facebook post, together with a project FAQs sheet [3]. We asked for people who have got heat pumps as a main heating systems and/or electric water boiler for DHW.

We presented a total of 27 possible end-users in the FLEXCoop plenary meeting in Athens (23-24 October 2018). The dwelling characteristics of those 27 possible end-users are described in Table 5 on Section 9.2. On December, we got a pre-final list of 15 candidates. In order to perform the final selection of the 9 end-users needed for the project more information is needed. So, the detailed pilot survey has been distributed to all the pre-final candidates.

A workshop with the pre-final candidates is going to take place on January the 31th 2019 in Barcelona. The aims of the workshop are to solve possible issues with the detailed survey, to explain the FLEXCoop project in detail to the end-users and to distribute the consent forms. During February 2019 we will get the information of the detailed survey for the final selection. Once we get the final selection candidates list, we will ask for the signed consent form. The consent forms template is added in Annex III of D1.2 Quality Management Plan.

#### **4.4. Dutch Pilot site**

In the surrounding of the small village of Heeten, the cooperative Endona is having a solar project with 5.000 solar panels. Moreover, it has obtained exemption from the legally regulated electricity tariffs as aforementioned in order to freely conduct research experiments. In addition, Endona is running the “Gridflex Project” [4]. Within this project and in collaboration with Enexis, Endona plans to demonstrate and assess the impact of several demand response services, including balancing of demand and supply on the distribution network and peak load reduction. Endona has 7.752 solar panels in the solar park and they just started a feasibility study for a battery in the solar park to enlarge the flexibility for delivery the electricity direct to their local consumers. All these activities were the reason to select pilot users who live in the area of Heeten. Our pilot Cooperative will be Endona.

The main way of heating house in the Netherlands is done by gas. In addition, DHW is heated by gas. That means that these houses will use an average of 3.500 kWh/year, mainly for lighting and household equipment. Because of the climate in the Netherlands normally there is no air-conditioning installed in the houses. Because of this, little flexibility is available in normal houses in the Netherlands.

The Netherlands is moving towards an energy transition to stop using gas and instead, use electric heat pumps for heating purposes. Early adopters are already using heat pumps. A heat pump for heating the DHW and a dwelling has a lot of flexibility potential, and this is the target for the Netherlands.

Twelve potential pilot users have been selected during December, with the premise of having already installed heat pumps in their houses. This recruitment has been done on a personal basis; people in the Heeten Village and in the cooperative Endona know each other. Furthermore,

advertising material about the FLEXCoop project, translated in Dutch, circulated among cooperative users.

The final selection of pilot users is planned to be ready in January 2019, since some additional information about the DHW storage tanks' volume is needed and is going to be collected in January. In February 2019, an information meeting will be organized for all the selected pilot users. Once the final candidates list is ready, signed consent forms will be circulated. During the project, we will organise other meetings as described in this document.

## **5. FLEXCOOP INSTALLATION PLAN**

### **5.1. Assigned roles in the installation process**

Selected pilot users allow access to their premises to project members and subcontracted installing companies, at least once to install sensors in the beginning and once or twice to install the OSB and additional devices for remote monitoring and control of the associated controllable devices (HVAC, water heater, lighting), as well as for other maintenance or problem fixing activities.

In general, installations in pilot dwellings are demanding procedures and in the most cases should be accomplished by specialized staff in a relatively limited time period. Therefore, it is necessary every task to be performed by the appropriate personnel. The work should be accomplished with high quality, precision and professionalism respecting the agreed timelines. Therefore, it is important to clearly define roles and their responsibilities. Indeed, roles, responsibilities and relationships amongst them are crucial to ensure smooth project implementation. In this section, the necessary key roles and their responsibilities are described in detail.

The identified roles, shown in Figure 4, include: Pilot Director, Technical Director, Commissioner, Technician, and End-user. End-users are of critical importance in the installation procedure because they will be the key actors interacting and using the final operational system. It should be mentioned that one or more roles can be assumed by the same expert, if s/he has the required competences and experience. For every key role mentioned above, activities and responsibilities are presented in parallel with the corresponding competences of the assigned personnel.

#### *5.1.1. Pilot Director*

Pilot Director is responsible for managing the whole installation process. His/her role is very wide and includes all non-technical issues along with managing the technical teams and communicating with end-users. Management skills and leadership are among the most critical skills of the person that will assume this role.

Main activities/responsibilities of the pilot director are:

- Implementation of the proposed Installation Management Plan
- Definition of roles and responsibilities
- Installation Process Evaluation

- Inspection and monitoring of installation work plan and technical teams respectively
- Monitoring of the procurement of the equipment
- Set a communication plan for appointment arrangements with end-users
- End-users engagement
- Assessment of end-user's feedback for further system configuration or optimization

Pilot Director's competences:

- Good management and communication skills
- Experience in similar with FLEXCoop projects where residential pilot users need to be engaged and actively participate
- Ability to manage and control groups of technicians
- Good knowledge and understanding of the overall FLEXCoop solution and its functionalities

#### *5.1.2. Technical Director*

Technical Director is responsible for the technical solution. S/he is assigned to guide the technical teams through every step of installation procedure, dealing with technical issues and troubleshooting. The Technical Director has an in-depth knowledge of the whole FLEXCoop integrated system and s/he is responsible for training technical staff, if deemed necessary. S/he may be requested to participate in technical staff evaluation and roles assignment as well as the general roll out of installation plan.

Main activities/responsibilities of the technical director are:

- Deep understanding of technical solution and system implementation
- Experience with system's components
- Deep knowledge of installation guidelines/instructions
- Deep knowledge of each installed device commissioning process
- Training of technical teams
- Evaluation of technical staff
- Provision of assistance to the commissioner and technicians for solving technical problems
- Assessment of delivered installations per pilot site
- Evaluation of the whole installation procedure
- Proposal of improvements, adjustments to technical solution provided based on both end-user's feedback and his/ her own experience.

Technical Director's competences:

- Excellent knowledge of technical issues, device commissioning and system integration
- Experience in relevant technical projects
- Good knowledge of hardware and software equipment and their operation
- Teaching/training skills
- Ability to support technical teams with short response time

### 5.1.3. Commissioner

Commissioner's key role is to implement the installation and commissioning procedures in every pilot site. Trained and supported by the technical director and accompanied, when needed, by the appropriate technician, commissioner's role is to begin from the scratch and deliver an operational system in each pilot site. S/he is responsible for installing plug 'n' play devices, for all devices commissioning and for system configuration and validation. S/he also provides first level support and copes with installation issues. Moreover, due to the fact that commissioner visits pilot sites, s/he has a major role on interacting with the end-users and explaining them and getting them familiar with system operation.

Main activities/responsibilities of the commissioner are:

- Installation of plug 'n' play devices
- Deliver instructions to technician for hard installations, when necessary
- Commissioning of all system devices
- System configuration
- System validation
- Troubleshooting
- Deliver ad hoc solutions to solve identified issues
- System presentation to end-users
- End-user engagement and awareness

Commissioner's competences:

- Experience in IoT device installations
- Communication skills
- First level knowledge on system configuration and software setups
- Basic knowledge on electric circuits and networking
- Strong technical skills

### 5.1.4. Technician(s)

Technicians may have a permanent or occasional role in the installation activities. They are assigned to fulfil hard device installations when commissioner is not competent to execute this job. Hard installations include installing for example an electric smart-meter in a switchboard. Technicians' role may vary according to site installation plan. It may be necessary technicians to take part in training activities.

Main activities/responsibilities of the technician are:

- Depending on the installation plan scenario, device installation may demand:
  - Electrician
  - Plumber
  - Network technician
- Awareness of installation actions for specific devices

Technician's competences: Certificate of professional competence

### 5.1.5. End-user(s)

End-users are the key players in installation process but also their contribution is critical to ensure a successful pilot demonstration of the FLEXCoop solution. End users:

- provide their property for installing and deploying the pilot system
- interact with pilot system during its operational phase providing the necessary data for system evaluation. The acquired data can be further be used for identifying and fixing bugs and providing necessary improvements and adjustments of the FLEXCoop solution.

It is obvious that end-users play a very important role and should be motivated to interact with the installed system.

Main actions of end-users are:

- To be engaged and interact with project actions and system(s)
- Providing their feedback and useful remarks

Excepting end-users, Figure 4 shows the other 4 assigned roles, with the description of the activities and competences that they can provide on behalf of installation phase of the project.



Figure 4: Assigned roles for the deployment phase

## 5.2. Installation Roadmap

### 5.2.1. Pre-installation Process

The first step in the installation plan is the pre-installation process (Figure 5), which consists in the preparation of the plan before the actual installation activities in pilot sites: purchasing equipment, organizing and coordinating the team, training. The **Pilot Director** (who plans, manages, executes and monitors all the defined installation activities as part of the project) asks for technical installation information to the **Technical Director** in order to know the equipment that exists and technical needs that must be fulfilled. In parallel, this knowledge provides the pilot director insight about the resources and installation guidelines that must be prepared. To address these needs, the pilot director assigns different roles that comply with specific duties regarding the installation process.

In order to start the Pre-Installation actions, the Pilot Director should have from the technical director and technical auditor the following information:

- Description of necessary roles and tasks
- Installation guidelines/manuals and commissioning instructions for optimal placement
- Building audit reports
- Estimation of installation time per pilot site
- List of necessary equipment for procurement

If required for the installation process, technical and/or engagement training workshops could be organised. Technical workshops could offer training on the installation of smart devices, software skills, etc.; they are managed by the technical director and target technicians. Engagement workshops could provide basic knowledge on do-it-yourself device installation, system configuration and software setups; they are managed by the commissioner and target residents and end-users.

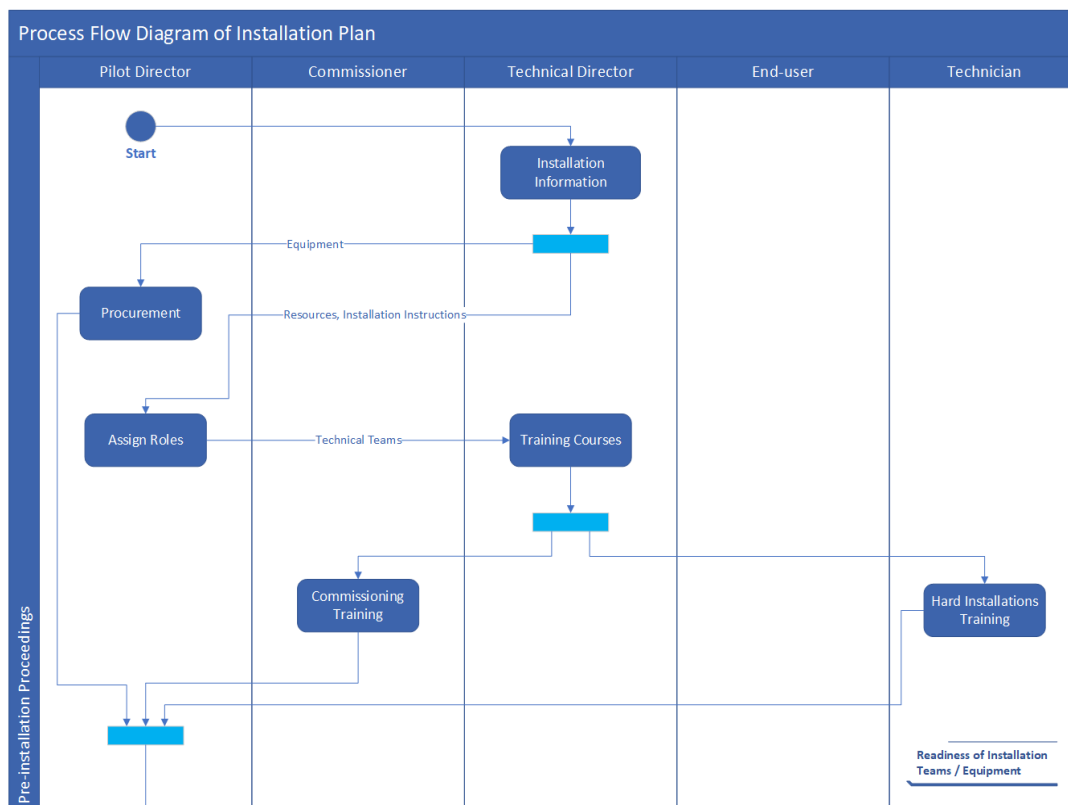


Figure 5: Process Flow Diagram of FLEXCoop Pre-installation Proceedings

The pre-installation procedure has a duration of 8 months: M12-M19 (September 2018- April 2019). As shown on Figure 6, the process started in M12 with the pre-selection of pilot participants in the project regarding the installation of the FLEXCoop solution and ends in M16 with the delivery of the complete list of pilot participants. During M17 (February 2019), surveys will collect information of existing equipment and characteristics of the dwellings, as well as legal signed consent forms to participate in FLEXCoop in relation with the GDPR context (See Section 4 for detailed information). Subsequently, the next two months proceed with the compilation of the equipment list to install in the selected pilot dwellings and the definition of the deployment plan, which is the aim of this deliverable. This process finalises with the order of the equipment to install.

Action	Deadline	Month/year
Final complete list of candidate users / Oral confirmation	M16	January 2019
Detailed Survey on Selected Pilot Sites	M17	February 2019
Consent forms signed	M17	February 2019
List of Materials and Deployment Plan	M18	March 2019
Order of Equipment	M19	April 2019

Figure 6: Pre-installation process timeline

### 5.2.2. Installation Management

The installation management (See Figure 7) of the FLEXCoop solution consists in the creation of the installation plan (clarifying the roles and responsibilities of everyone within the project team), the arrangement of installation activities (Splitting the work in reasonable and equitable packages), and the assignment of tasks to appropriate member staffs. It is led by the **Pilot Director** and implies the end-users and technicians (under the supervision of the **Technical Director**).

The main objectives of the proposed installation management plan are to organize and efficiently perform all system installations, to minimize cost and necessary visits per pilot site, to keep time commitment and, last but not least, to interact with end-users for promoting project benefits.

The proposed installation management plan is based upon a list of actions that will conclude in achieving project objectives. These actions are:

- Robust organize of technical tasks
- Good work flow monitoring management
- Correct role assignment and activation of the appropriate personnel
- Friendly interaction and approach to end-users

#### 5.2.2.1. Assignment of tasks

During the implementation phase of the equipment installation, the installation management defines detailed responsibilities among FLEXCoop partners, and several tasks & monitoring activities to comply with:

- At dwellings of residential end-users: the implementation phase will be done by the hired subcontractor of the pilot or the pilot partner, who also will pay the subcontracted installing companies with their allocated budget.
- At the Pilot Cooperative for the Aggregator services: the implementation phase will be done by ETRA & Hypertech. These services will be hosted in FLEXCoop servers and web access will be available for the Cooperatives.
- The health of the installation will be monitored by Grindrop. The pilot partner will be responsible to provide physical support to the end users.
- If some commercial device is broken, it has to be replaced and installed by the pilot partner on the condition that the budget limitation is 500€/pilot participant at both cooperatives; except the OSB which can be replaced by the partner Grindrop.
- Apart from the devices installation (or maintenance), there are no foreseen visits to dwellings.
- If one or more participants quit the project during the piloting period, pilot cooperatives should find new participants.
- Contribution from cooperatives is expected at the deployment of the software and final evaluation. There should be feedback either through workshops participation or via questionnaires.



### 5.2.2.2. Installation Time Plan

The installation plan regards the timeline and description of whole installation package and every installation action in pilot sites. It begins with the selection of pilot sites and the communication with the pilot end-users for arranging installation visits. The Pilot Director would be responsible to call or contact with the owners of the selected pilot sites and schedule the visit of technical team (commissioner and technicians) in order to perform system installation and device commissioning.

In case, some of the pilot users have withdrawn their interest in participating at the installation actions, then the pilot director should try to engage them again by explaining them the benefits and the impact of participating in such an action. In case they have not changed their mind, then the pilot director should resort to other end-users from the Pilots pool. It is important that an audit reference is always available for every selected pilot site. The next step is to concentrate in a list all appointment arrangements.

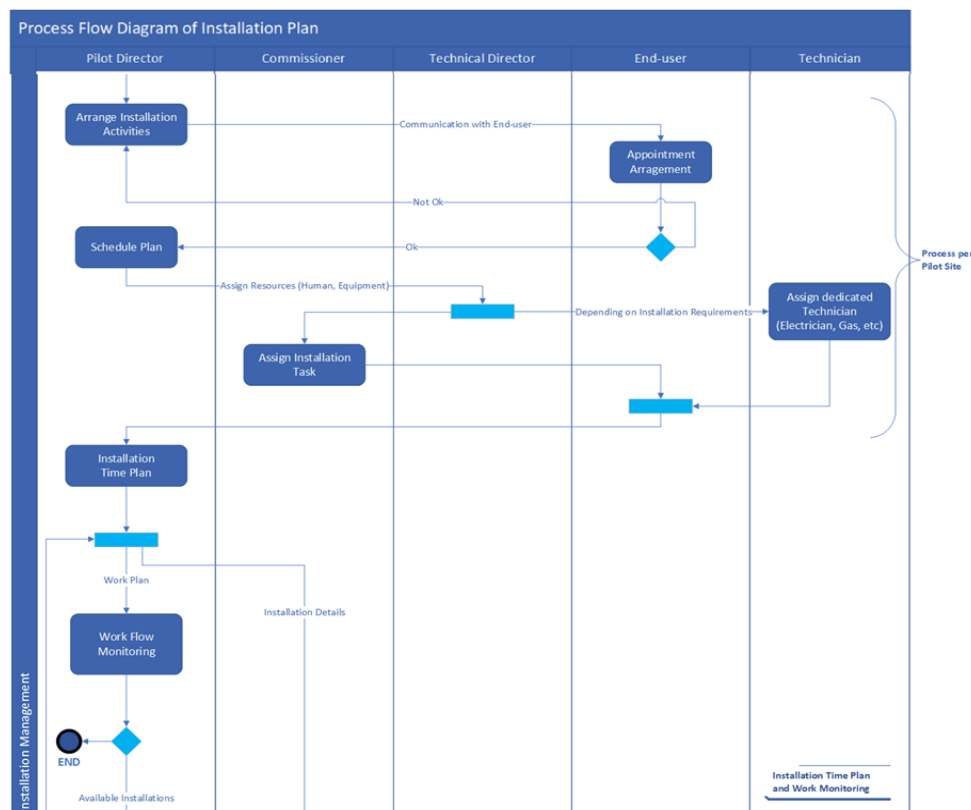


Figure 7: Process Flow Diagram of FLEXCoop Installation Management

### 5.2.3. Installation Procedures

This is the phase of the installation actions, configuration, testing and monitoring of the FLEXCoop equipment. As shown in Figure 8, this phase is mostly led by the **Commissioner**, implying end-users, and **technicians** in the case of hardware installation. This phase entails the performance of the activities in each pilot site, described in the following subsections.

### 5.2.3.1. Device Installation

Device installation should follow a specific sequence for establishing system integration and operability. Installation and commissioning instructions/manuals of each device are provided and should be followed in every step of commissioning from both technicians and commissioners. Instructions for optimal placement and good practice are also provided. Generally, the whole device installation procedure is described in the following steps:

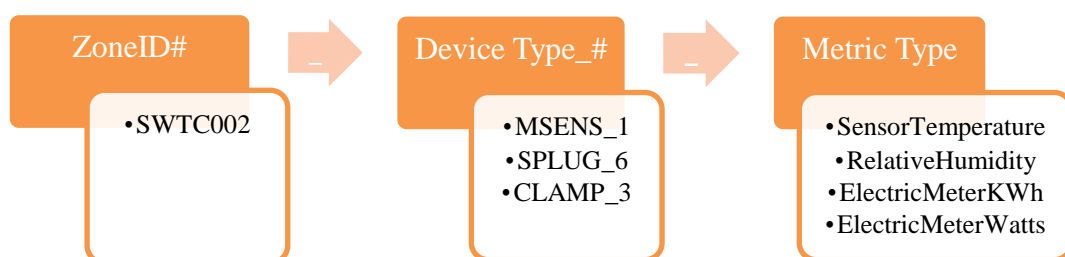
- Perform installation and pre-OSB equipment (equipment and main constraints that should be installed and be operational before Smart-Box installation)
- Perform installation of OSB and hard equipment.
- Perform commissioning of all the rest devices taking under consideration instructions for optimal placement resorting to enhancement of system performance.
- Each device should be installed based on the installation manual and manufacture commissioning processes while:
  - Plug ‘n’ play devices are installed by the commissioner(s)
  - Devices that demand hard installations are exclusively performed by dedicated technician(s)

In each one of the above tasks the installed equipment is further categorized based on its usage (submetering, ambient sensing, etc.) while we propose specific commercial off-the-shelf products and/or customized equipment (detailed description is provided in D4.1) that serve utmost our Smart Home approach.

### 5.2.3.2. System Configuration

The system configuration is managed by commissioner, and includes:

- ❖ Correct device labelling of each installed component according to the following label system for easy traceability (automated labelling process to be discussed).



For example, label *SWTC002\_CLAMP\_3\_ElectricMeterKWh* refers to the electric energy measurement in KWh of the clamp no. 3 in the SWT zone no. 2.

- ❖ Check device operation, which activity is the test system configuration and the communication checking with server's database.
- ❖ Commissioner will leave the zone only when all devices installed work correctly.

### 5.2.3.3. Troubleshooting

Troubleshooting should be primarily commissioner's task. Commissioner should resort to technical director for further instructions, when the problem continues. Extra tasks should be done, together with technicians and technical director.

### 5.2.3.4. Installation Process Monitoring

At the end of all installation processes in every pilot site there should be a final check that everything works fine and data from sensing devices are collected from OSB and delivered to a distant database or cloud service. The monitoring process is accomplished partially by the Technical Director and the Commissioner. Their main tasks are: Come across a Check list of processes that ensure all installation processes have been fulfilled as planned; Check data delivery; Assess from initial measurements that equipment functions as expected before leaving the installation site.

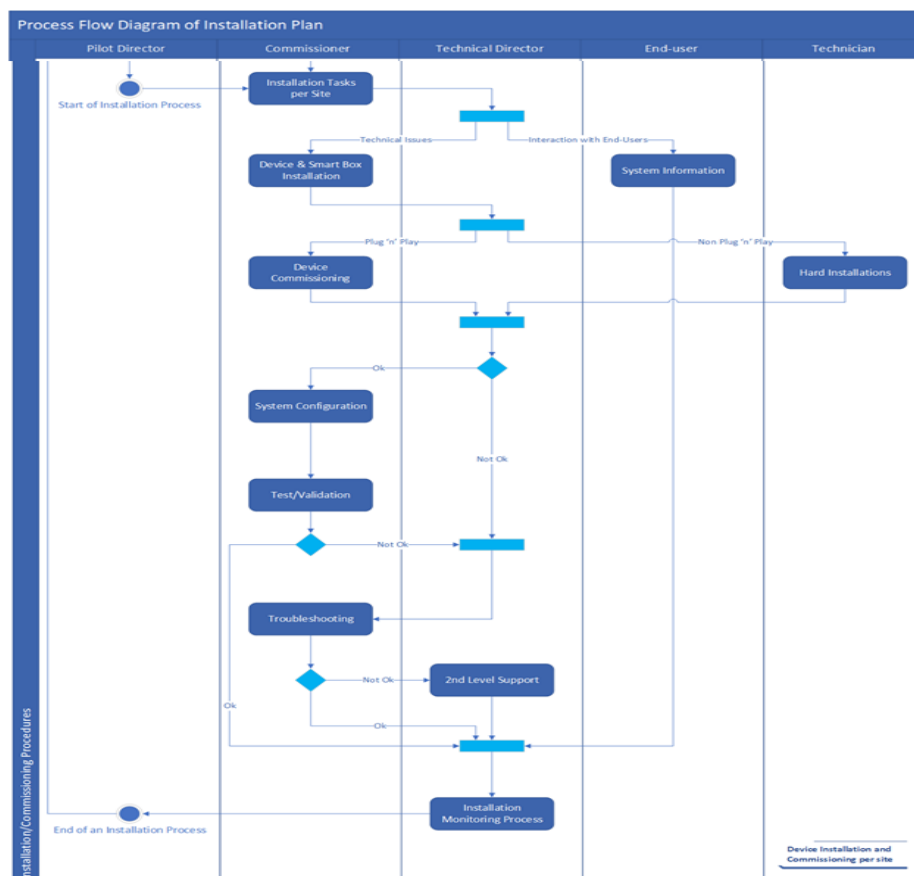


Figure 8: Process Flow Diagram of FLEXCoop Installation Procedures

This procedure starts in M20 and finishes in M26 (See		
Installation of Sensors /Early Version of OSB (HW finalized – SW preliminary version)	M20	May 2019
OSB software upgrades	M20	May 2019
<b>1st Full Functionality Version of OSB – D4.2</b>	M20	May 2019
Initial calibration of models and profiles	M20-M26	May - November 2019
Testing - Remote Upgrades (finetuning & extensions) of OSB SW / maintenance	M20-M26	May - November 2019

Figure 9). Therefore, the detailed plans for the installation tasks in each pilot site, the system configuration, testing and monitoring will be delivered in the next version of the FLEXCoop system deployment at pilot sites (D7.3).

Action	Deadline	Month/year
Installation of Sensors /Early Version of OSB (HW finalized – SW preliminary version)	M20	May 2019
OSB software upgrades	M20	May 2019
<b>1st Full Functionality Version of OSB – D4.2</b>	M20	May 2019
Initial calibration of models and profiles	M20-M26	May - November 2019
Testing - Remote Upgrades (finetuning & extensions) of OSB SW / maintenance	M20-M26	May - November 2019

Figure 9: Devices installation timeline

### 5.3. Installation guideline

The main objectives of the proposed installation management plan are to organize and perform all system installations with efficiency and effectiveness. The main goals that need to be achieved are:

- to minimize cost
- to eliminate necessary visits per pilot site
- to ensure alignment with the time schedule
- to interact with end-users
- to promote project scope and objectives as well as benefits stemming from its implementation.

The FLEXCoop installation process has been structured following five key action items:

- Robust organisation of technical tasks
- Good work flow monitoring management
- Correct role assignment and activation of the appropriate personnel
- Friendly interaction and approach to end-users
- Enhanced dissemination activities to keep the engagement of end users as high as possible

The basic elements that need to be taken into account to ensure a smooth installation and on-time execution of all the relevant activities are:

- **Human Resources.** Human factor plays a catalytic role in goals achievement. Therefore, all actions should be divided in reasonable way and assigned to appropriate personnel. In FLEXCoop installation process, human resources contain the following two actions:
  - **Roles assignment.** Description of the roles and time commitments of personnel.
  - **Training.** Trainings, especially for the technical teams (when required), over installation processes and device commissioning of all equipment that will be used in pilot sites.

- **Equipment.** Selecting appropriate equipment and depleting all market margins can reduce budget costs while enhancing delivered system quality. It includes:
  - **Assessment of required equipment.** Gathering and assessing the required equipment can be done by careful examination of pilot surveys in combination with FLEXCoop requirements and installation guidelines
  - **Specified Equipment procurement.** Procedures for providing the required equipment, installation tools and consumables within the specified time scales.
- **Installation Time Plan.** A plan that incorporates scheduled installation appointments along with human resources and required equipment under an efficient manner that minimizes costs and human resources. Installation time plan demands:
  - **Schedule Plan.** Communication with end-users for arranging installation appointments.
  - **Assigning resources.** Assigning equipment and human resources for each installation action inside the time plan.
- **Installations per pilot site.** All actions and processes that must be successfully completed in each pilot site by the dedicated personnel.
  - **Required equipment (Bill of Materials).** A list with the specific required equipment per installation.
  - **Device installation & commissioning.** Equipment installation and commissioning based on the installation instructions and commissioning manuals.
  - **System configuration and testing.** Testing and configuration actions based on a tracking document.
  - **Troubleshooting.** Actions to cope with if installation difficulties are faced
  - **Installation monitoring process.** System validation based on a final checklist and on evaluation of delivered data.
- **Installations supervision.** Actions of work flow management that include:
  - Monitoring of the installation time plan implementation
  - Execution of re-arrangements and solve unexpected problems including a list with the contact details of all involved personnel that can help when an issue occurs
  - Performance evaluation
  - Suggest adjustments and improvements
- **End-users Communication/Engagement.** Define communication channels with end-users and interact with them for establishing a bilateral relationship in order to:
  - Promote FLEXCoop project scope, objectives and potential benefits stemming from its implementation.
  - Evaluate their feedback and interaction with the installed operational system.

## 6. PRELIMINARY EQUIPMENT INSTALLATION DESCRIPTION

### 6.1. Bill of materials of one friendly user from Spain

Friendly User 1						
Heat Pump						
Device Name	Where to be installed	How to be installed	Unit Price	Quantity	Total Price	Without VAT
Z-Wave Plus Aeotec Clamp Power Meter - Three Clamps (60A)	Heat Pump Switch	20'	113,58 €	1	107,45 €	88,52 €
IntesisBox WIFI - DAIKIN AC (DK-RC-WMP-1)	Heat Pump Thermostat	20'	190,00 €	1	201,59 €	177,30 €
Electric Domestic Hot Water (DHW)						
Device Name	Where to be installed		Unit Price	Quantity	Total Price	Without VAT
Z-Wave Plus Aeotec Smart Switch 6 - Schuko	Fagor CB-100N (1800W) plug	DiY	67,48 €	1	61,35 €	50,10 €
Other equipment required (off-the-self sensors, total consumption metering, etc.)						
Device Name	Where to be installed		Unit Price	Quantity	Total Price	Without VAT
Z-Wave Plus Aeotec Clamp Power Meter - Three Clamps (60A)	Fuse Box (For total consumption meterin)	20'	113,58 €	1	107,45 €	88,52 €
Z-Wave Plus Aeotec MultiSensor 6	Instructions will be given shoon	DiY	66,36 €	3	192,95 €	159,77 €
P 5 V 2 A USB Adaptor, black	Multisensor adaptor	DiY	5,99 €	3	21,92 €	17,97€
Labour Costs						
2 hours of work (25€/h + travel expenses)					117,13 €	96,80 €
<b>Total Equipment and installation Cost:</b>			<b>809,84 €</b>		<b>678,98 €</b>	

Table 3: Bill of materials of Spanish friendly user

## 6.2. Bill of materials of two friendly users from The Netherlands

Friendly User 1						
Equipment Required (off-the-self sensor, total consumption)						
Device Name	Where to be installed	How to be installed	Indicative Unit Price	Quantity	Total Price	Without VAT
Z-Wave Plus Aeotec Clamp Power Meter - Three Clamp (60A)	Fuse Box (total home consumption)	20'	113,58 €	1	113,58 €	94,65 €
Z-Wave Plus Aeotec MultiSensor 6	Instructions will be given shoon	DiY	66,36 €	3	199,08 €	165,90 €
P 5 V 2 A USB Adaptor, black	Multisensor Adaptor	DiY	5,99 €	3	17,97 €	14,98 €
Lighting						
Device Name	Where to be installed		Indicative Unit Price	Quantity	Total Price	Without VAT
TRÅDFRI Verbindingshub, wit (Gateway)	Living room	DiY	32,95 €	1	32,95 €	27,23 €
TRÅDFRI Draadloze dimmer, wit	Living room	DiY	9,99 €	1	9,99 €	8,26 €
TRÅDFRI Led E27 1000 lumen, draadloos dimbaar, globe warm wit opaalwit	Living room Replace 4x energy saving lamp	DiY	9,99 €	4	39,96 €	33,02 €
<b>Total Equipment Cost:</b>					<b>413,53 €</b>	<b>344,04€</b>

Friendly User 2					
RES and related equipment (batteries)					
Device Name	Where to be installed	Unit Price	Quantity	Total Price	Without VAT
Z-Wave Plus Aeotec Clamp Power Meter - One Clamp (60A)	<a href="#">SMA Sunny Boy SB 2500HF-30</a>	89,98 €	1	89,98 €	74,98 €
Electric Domestic Hot Water (DHW)					
Device Name	Where to be installed	Unit Price	Quantity	Total Price	Without VAT
Buderus E-Heizung 2 KW mit Regelung 5238250	Buderus Water Tank (SM300/1W)	380,49 €	1	380,49 €	319,74 €
7747029313 Buderus Handlochdeckel mit Muffe G1 1/2 Zoll	Buderus Water Tank (SM300/1W)	126,62 €	1	126,62 €	106,40 €
Z-Wave Plus Aeotec Smart Switch 6 - Schuko	Buderus Water Tank (SM300/1W) Electric Heater Plug	67,48 €	1	67,48 €	56,23 €
Other Equipment Required (off-the-self sensor, total consumption)					
Device Name	Where to be installed	Unit Price	Quantity	Total Price	Without VAT
Z-Wave Plus Aeotec Clamp Power Meter - Three Clamp (60A)	Fuse Box (total home consumption)	113,58 €	1	113,58 €	94,65 €
Z-Wave Plus Aeotec MultiSensor 6	Instructions will be given shoon	66,36 €	3	199,08 €	165,90 €
P 5 V 2 A USB Adaptor, black	Multisensor adaptor	5,99 €	3	17,97 €	14,98 €
				<b>995,20 €</b>	<b>832,88 €</b>

Table 4: Bill of materials of Dutch friendly users



## 7. CONCLUSIONS

The pilot planning, described in Section 2, comprises the general plan and timeline for the phases to be performed in the pilot sites, including the deployment plan, the integration plan and the pilot roll-out and demonstration. The aim of this deliverable is the description of the deployment plan of the FLEXCoop solution, which lasts from June 2018 (M9) to November 2019 (M26)

The initial trial is the first step of the deployment plan and consists in the FLEXCoop installation in dwellings of three friendly users from the Spanish and the Dutch pilot site. The timeline with the complete installation has been achieved so far, and the trial period has begun.

Meanwhile, the participation of selected pilot users in the FLEXCoop project is an ongoing phase, finalizing at January-February 2019, coinciding with the execution of the first workshop in both pilot sites, separately. The first workshop entails the selection of pilot participants in the project, including the circulation of surveys and consent forms, explanations of the project, the FLEXCoop solution, and the related legal and bureaucratic issues. More workshops regarding the FLEXCoop installation activities will be organised at the end of 2019 and 2020, as well as Living Lab activities.

The installations process in pilot dwellings imply the involvement of specialized staff in a relatively limited time period for the execution of all the installation activities. With the aim of specify the specific assigned roles in charge of different responsibilities in the installation process, this deliverable has described 5 main roles: Pilot Director, Technical Director, Commissioner, Technician, and End-user, being the end-users the key actors in the installation procedure since they interact and use the final operational system. Each role and their responsibilities have been described in Section 5.1.

This deliverable has achieved the description of the main steps of the installation plan in relation with its timeline, as well as the delivery of the installation guideline for the FLEXCoop equipment in the pilot participants' dwellings. The installation plan consists in three phases: the pre-installation process, the installation management and the installation procedures. The pre-installation is the preparation of the plan regarding the purchasing equipment, organizing and coordinating the team. The installation management outlines the plan for the equipment installation, the arrangement of installation activities, and defines detailed responsibilities among FLEXCoop partners, and several tasks & monitoring activities to comply with. The installation procedure is the phase of the installation per se, configuration, testing and monitoring of the FLEXCoop equipment.

Finally, the last section of the deliverable presents the bill of materials to purchase in the friendly users' dwellings, including the total equipment cost and the labour costs for the installation of the equipment.

As stated in the Executive Summary, this is the first version of the deployment plan from Task 7.2. The detailed plans for the installation tasks in each pilot site, the equipment description and the system configuration will be delivered in the second version of the FLEXCoop system deployment at pilot sites (D7.3). The final version of the deployment plan (D7.6) will be delivered in M33, after the fulfilment of the optimisation of the whole FLEXCoop solution and roll out of the second trial phase.

## 8. REFERENCES

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## 9. ANNEXES

### 9.1. Pilot Survey template

#### Demographics

This is very important information. You need to check with pilot users if this information is already available beforehand or through the questionnaires from T2.1. Maybe this was already collected from some previous source. If this is the case, you should remove the already answered questions.

Information required	
Household Composition (Please fill how many members of the household are in each age category)	<input type="checkbox"/> Under 18 years old <input type="checkbox"/> 18-24 years old <input type="checkbox"/> 25-34 years old <input type="checkbox"/> 35-44 years old <input type="checkbox"/> 45-54 years old <input type="checkbox"/> Over 54 years old
Employment Information (Please fill how many members of the household are in each employment status category)	<input type="checkbox"/> Employed full time <input type="checkbox"/> Employed part time <input type="checkbox"/> Self-employed <input type="checkbox"/> Unemployed <input type="checkbox"/> Student <input type="checkbox"/> Homemaker <input type="checkbox"/> Retired
Digital skills	<input type="checkbox"/> Not familiarised at all <input type="checkbox"/> PC owner <input type="checkbox"/> Tablet owner <input type="checkbox"/> Smartphone Owner <input type="checkbox"/> Smart home Devices Owner <input type="checkbox"/> Other
Free comments	

### Building information

Please fill in the table with the following information.

ATTENTION: The Apartment ID should be a unique number that will identify the final pilot users. It should be filled in by the cooperatives. It could be a number like for example:

#### FL-01-N or FL-05-S where

- FL stands for FLEXCoop,
- 01, 02, ..., N is an increasing number that will uniquely specify each dwelling that will be used by FLEXCoop for pilot demonstration
- N stands for Netherlands and S for Spain

Information required	
Apartment ID	Please identify a unique ID for each dwelling
Location (postal code is enough, complete address will be valuable)	
Dwelling Tenancy regime	<input type="checkbox"/> Rented <input type="checkbox"/> Ownership <input type="checkbox"/> Usufruct
Type of dwelling you live in	<input type="checkbox"/> Detached <input type="checkbox"/> semi-detached house <input type="checkbox"/> Apartment building
Size of dwelling	<input type="checkbox"/> Less than 50 m <sup>2</sup> <input type="checkbox"/> 50–100 m <sup>2</sup> <input type="checkbox"/> 100–150 m <sup>2</sup> <input type="checkbox"/> 150–200 m <sup>2</sup> , <input type="checkbox"/> 200–250 m <sup>2</sup> , <input type="checkbox"/> More than 250 m <sup>2</sup>
Topology of the building (number of rooms etc) (For each entry please fill the <b>correct number</b> )	<input type="checkbox"/> Floor level (in case of apartment building) <input type="checkbox"/> Number of floors <input type="checkbox"/> Number of kitchens <input type="checkbox"/> Number of bathrooms <input type="checkbox"/> Number of living rooms <input type="checkbox"/> Number of bedrooms
Please specify the preferred/most suitable area(s) for intervention (e.g. living room)	

Does the building have internet connectivity?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Does the building have wifi connectivity?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Please specify your current electricity tariff scheme (e.g. single rate, time of use, controlled load, etc.)	
Approx. building annual electricity consumption (info can be found from electricity consumption bills)	
Frequency of readouts (info can be found from electricity consumption bills)	
Historical readouts available (historical traces of consumption for baseline)	This info is needed for baseline <input type="checkbox"/> No <input type="checkbox"/> Yes; For what time period (e.g. one year):
What type of heating system is used?	<input type="checkbox"/> Individual (e.g. a heating system used/controlled only by one apartment) <input type="checkbox"/> Central (e.g. one central heating system serving the needs of all the apartments in an apartment building) <input type="checkbox"/> District/Collective
What type of cooling system is used?	<input type="checkbox"/> Individual (e.g. a cooling system used/controlled only by one apartment) <input type="checkbox"/> Central (e.g. one central cooling system serving the needs of all the apartments in an apartment building) <input type="checkbox"/> District/Collective
What type of Water Heating is used?	<input type="checkbox"/> Individual (e.g. point of use for large dwellings) <input type="checkbox"/> Central (traditional case where one water heating system serves the needs of one whole apartment) <input type="checkbox"/> District/Collective
Free comments	

## Other Infrastructure

Information Required	
<p>Are you familiar with smart home solutions?</p> <p>If yes, do you have any smart home solution (e.g. smart lights, smart TV)? Please specify</p>	
Local electricity generation from RES	<input type="checkbox"/> No <input type="checkbox"/> Yes; If yes, please specify the RES type (e.g. PV, small wind turbine):
Your RES system is	<input type="checkbox"/> grid connected <input type="checkbox"/> stand-alone / off grid <input type="checkbox"/> hybrid <input type="checkbox"/> N/A
Approx. annual electricity production (please provide info per RES defined above)	
Do you own a battery for RES production storage?	<input type="checkbox"/> No; <input type="checkbox"/> Yes;
Do you own an EV?	<input type="checkbox"/> Yes, I have a plug-in hybrid EV (PHEV). <input type="checkbox"/> Yes, I have a non-plug-in hybrid EV (HEV). <input type="checkbox"/> Yes, I have a pure EV (BEV). <input type="checkbox"/> Yes, I have an electric bike <input type="checkbox"/> No. I do not have an EV.
Free comments	

## Available equipment

<b>Available equipment</b>	
<b>Please check the available equipment for your dwelling. (HVAC, lighting, water heater)</b>	<b>Lighting</b> No <input type="checkbox"/> , Yes <input type="checkbox"/> ; <b>Electric HVAC</b> No <input type="checkbox"/> , Yes <input type="checkbox"/> ; <b>Electric Domestic Hot Water</b> No <input type="checkbox"/> , Yes <input type="checkbox"/> ;
For each equipment provided above please give more concrete info below (the questions are organised per type of equipment)	
Free comments	

## Lighting

This information can be easily gathered by the pilot users themselves. We plan to install equipment and demonstrate the FLEXCoop solution in specific rooms/areas of each pilot dwelling.

**Attention!** All lights of the intervention areas should be under FLEXCOOP control! If there are no smart lights in the pilots, we will assess each individual case and perhaps we may install new wireless lighting solution.

Please fill in the following table *ONLY* for candidate intervention areas (as indicated in the table of Section 0).

Lighting		
<b>Number and type</b> of bulbs installed in each potential intervention area  (e.g. Living room: 4 LED bulbs)   *All lights of the intervention areas should be under FLEXCOOP control	Please specify for each possible intervention room/area, the number and type of bulbs already installed	
	<input type="checkbox"/> Living room: <input type="checkbox"/> Bedroom 1: <input type="checkbox"/> Bedroom 2: <input type="checkbox"/> Kitchen: .....: .....: .....:	<i>Possible bulb types</i> <ul style="list-style-type: none"> <li>LED</li> <li>incandescent</li> <li>fluorescent</li> <li>halogen</li> <li>compact fluorescent</li> <li>smart lights</li> </ul>
For each smart light please specify manufacturer and model  (e.g. Philips Hue Beyond Starter, 7121231PH)		
Free comments		




## Electric HVAC

▪ **Electric HVAC Generic Information**


The information about HVAC should be gathered in staging approach. This first table can be filled in by the end users themselves with instructions of cooperatives representatives. Depending on the answers, we will select the most appropriate dwellings.

**Attention: Ideal candidates are those having SG Ready Label heat pumps.**

**If the model and manufacturer are not known please ask for a photograph of the device! If not possible at this stage, it can be filled in afterwards during the on-site visit by an assigned expert.**

Electric HVAC	
Please specify <b>manufacturer name</b> and <b>model</b> (e.g. GREE Change Ecodesign Series, GRS 101 EI/JCDA-N2)	
What is the HVAC system type?	<input type="checkbox"/> Air conditioner Air/Air (split units)  <p><b>Note: Air–air heat pump (transfers heat to inside air)</b> – This category refers to <b>ductless</b> mini-splits that connect one or more indoor coils (often referred to as “heads” or “fan coils”) to a single outdoor unit, with each head having its own refrigerant loop.</p> <input type="checkbox"/> Air to water heat pump  <p><b>Note:</b> Air–water heat pump transfers heat to a heating circuit and a tank of domestic hot water</p> <input type="checkbox"/> Air to air heat pump  <p><b>Note: Air–air heat pump (transfers heat to inside air)</b> – This category refers to conventional air to air heat pumps that have one indoor coil in an air-handling unit and use forced-air distribution through <b>ductwork</b> to deliver conditioned air to various zones within a home.</p> <input type="checkbox"/> Other (please specify)
Do you have a SG Ready Label Heat Pump?	<input type="checkbox"/> No; <input type="checkbox"/> Yes;
Which of the following are connected to the HVAC system?	<input type="checkbox"/> Radiators <input type="checkbox"/> Underfloor systems <input type="checkbox"/> Hot Water tank <input type="checkbox"/> Fan coils



	<input type="checkbox"/> Registers <input type="checkbox"/> Other (if any, please specify)
How the HVAC system is controlled?  (if multiple devices please indicate for each one)	<input type="checkbox"/> IR controller for each air-conditioner?  <input type="checkbox"/> One thermostat for the whole dwelling <input type="checkbox"/> One thermostat per room <input type="checkbox"/> Thermostat is attached on the emitter (Please write the radiator manufacturer name and its model as well) <input type="checkbox"/> Other (please specify)
Where the HVAC system is located in the dwelling?  (if multiple devices please indicate where each one is placed)	
Free comments	

### ▪ Electric HVAC Detailed Technical Information

This table should be filled in a second stage after assessment of the previously filled information. Visits in the selected dwellings are needed. We should follow a train-the-train approach to train an expert (who must already have a technical background) in order to fill in the following information.

Please fill in the following information for each HVAC device defined above. (This info will be gathered in a second phase in the survey only for selected pilot users)	
What is the nominal power of the system?	Heating:  Cooling:
What is the heating/cooling capacity of the system?	Heating:  Cooling:
What is the Seasonal Coefficient of Performance (SCOP) and Seasonal Energy Efficiency Ratio (SEER) of the system?	SCOP:  SEER:
<b>OR</b>  For older system please specify the heating/cooling COP of the system instead.	<b>OR</b>  Heating COP:  Cooling COP:
<b>For each installed thermostat in the dwelling, please complete the following table</b>	
Manufacturer Name	
Model (or Serial Number)	
What room / area does this thermostat control?	
Is it possible to capture remotely the setpoints that users apply?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know
Free comments	





## Electric Domestic Hot Water (DHW)

- **DHW Generic Information**

The information about DHW should be gathered in staging approach. This first table can be filled in by the end users themselves with instructions of cooperatives representatives. Depending on the answers, we will select the most appropriate dwellings.

Ideal candidates are users with simple Domestic hot water (DHW) tanks. Other cases will only be assessed, if deemed necessary.

**If the model and manufacturer are not known yet please ask for a photo of the device! If not possible at this stage, it can be filled in afterwards during the on-site visit.**

Electric Water Heating system	
What type of water heating system do you have?	<input type="checkbox"/> Electric Boiler ( <b>Note:</b> A boiler can heat water that is used to <b>heat the home and provide hot water</b> ) 
	<input type="checkbox"/> Tankless heaters 
	<input type="checkbox"/> Domestic hot water (DHW) heat pump 
	<input type="checkbox"/> Domestic hot water (DHW) tanks ( <b>Note:</b> A water heater is a storage tank that <b>heats and stores water</b> ) 
	<input type="checkbox"/> Other (please specify)
Please specify manufacturer/model	
Is your DHW tank connected to your heat pump?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(Please answer this question if applicable)	
Free comments	

▪ **DHW Detailed Technical Information**

This table should be fill in a second stage after assessment of the previous filled information. The assigned expert will fill in the table during the on-site visit.

Please fill in the following information only for Electrical DHW tanks (This info will be gathered in a second phase in the survey for the remaining pilot users)	
<b>Only for Electrical DHW tanks</b>	
What is the nominal power of the system?	
What is the tank water capacity?	
How is the Water Heater controlled?	<input type="checkbox"/> Relay Nominal Power: Model: <input type="checkbox"/> Thermostat Manufacturer: Model:
Please specify the number of phases? (Single Phase / 3-Phase)	<input type="checkbox"/> Single Phase <input type="checkbox"/> 3-Phase
Free comments	

## RES and related equipment (batteries)

Please fill in the following table only if the dwelling has RES installed. The information can be filled by the users themselves with instructions from the cooperatives' representatives. If they face difficulties to complete this information, the remaining questions will be filled in by the assigned expert.

<b>Available equipment</b>	
<b>Photovoltaics</b>	
Please specify the PV installed capacity (e.g. 10kW)	
Please indicate information about the inverter(s) type and topology	Manufacturer: Model: Number of inverters: Where the inverter(s) are located:
Do you have a grid connected inverter with integrated battery (e.g. ABB REACT)	<input type="checkbox"/> Yes, please specify the manufacturer and model:  <input type="checkbox"/> No
Where the PV electrical panel is located?	
Free comments	
<b>Battery</b>	
Please provide PV battery(ies) information  (provide information per battery, if applicable)	<ul style="list-style-type: none"> <li>• Manufacturer / Model:</li> <li>• Storage Capacity (kWh):</li> <li>• Useable Capacity (kWh):</li> <li>• Battery Chemistry (e.g. Lithium, Lead Acid):</li> </ul>
Please indicate information about the battery inverter(s) type and topology (if applicable)	Manufacturer: Model: Where the inverter(s) are located:
Free comments	

## EVs

Please fill in the following table only if the user has an EV. The information can be gathered by the users themselves with instructions from the cooperatives' representatives. If they face difficulties to complete this information, the remaining questions will be filled by the assigned expert.

Available equipment	
<b>EVs</b>	
Please specify the EV manufacturer and model	
Please indicate plug-in charging (in hours) – <i>if applicable</i>	
Battery capacity (kWh)	
Quick charging (e.g. 50kW – 30min 80%) <i>if applicable</i>	
Average energy consumption (kWh/100km)	
Which is the average distance that you cover daily?  (you may provide different estimation for week days and weekends)	
Do you charge your EV at home?	<input type="checkbox"/> Yes, please give details about the connector <input type="checkbox"/> No
Free comments	

### Routines and use of energy

This information will be gathered only for the final selected pilot users. We should have gathered all the information (including those of the paragraphs □ and 0). It is the last information that should be gathered.

Information required		
Do you have common patterns on the usage of water heater devices during your presence in premises?	<input type="checkbox"/> High, please specify a rough estimation of schedules: <input type="checkbox"/> Low, please specify a rough estimation of schedules: <input type="checkbox"/> Limited	
Do you have common patterns on the usage of HVAC?	<input type="checkbox"/> High, please specify a rough estimation of schedules: <input type="checkbox"/> Low, please specify a rough estimation of schedules: <input type="checkbox"/> Limited	
Do you have common patterns in using and/or charging your EV?	<input type="checkbox"/> High, please specify a rough estimation of schedules: <input type="checkbox"/> Low, please specify a rough estimation of schedules: <input type="checkbox"/> Limited	
Could you please indicate a rough estimation of presence and absence schedules on weekdays and weekends (in case of multiple occupants provide a rough average schedule for all)	<b>Weekdays</b>	<b>Weekends</b>
	Leaving Home:	Leaving Home:
	Entering Home:	Entering Home:
Free comments		

## 9.2. Spanish pilot survey

As described in section 4.3, we have elaborated a questionnaire in order to get the candidates who best fit with the project requirements, as well as to gather the information needed for the best participants' selection. The questionnaire was distributed through the mail to the local groups and the Facebook post. The 27 answers of this questionnaire are presented in the following table 3.

The following participants (also marked in green in Table 5) are pre-selected as a possible end-user: FL1S (friendly end user), FL2S, FL3S, FL4S, FL5S, FL6S, FL7S, FL8S, FL9S, FL14S, FL16S, FL17S, FL22S, FL23S, FL25S and FL26S.

The final selection of the 9 end users, is going to be done based on the information that they will provide through the detailed questionnaire.

Table 5: Results of the 27 possible participants who applied to participate in the FLEXCoop project as end users. Participants marked in green are pre-selected as an end-users.

ID	Main heating system in the house	Please specify	N° heat pumps	Heat pump model and brand	N° of electric radiators	Brand and model of the electric radiators	Electric water heater	Model and brand of the electric water heater	Annual consumption (kWh)	Power	Tariff	City	PV	Installed power (for the solar panels)	Batteries	Capacity batteries	EV	Brand and model of the EV	Km/year?	Do you have smart EV charger?	Which model is the EV charger	Charger at your home?	Internet connection at your home?
FL1S	Heat pump		1	Daikin RQ125B7W1B	1	Ecotermi Mod. Star 7 RA1S721R	Yes	Fagor CB-100 N	8000	10	2.0 DHA	Olot	No		No		No						yes
FL2S	Heat pump		3	MITSUBISHI	3	PRIMO 2000W	Yes	VITREX	5000	5.75	2.0 DHA	GIRONA	Yes	2.6	Yes	4	Yes	VECTRIX VX1 LI+	20000	yes	schuko	yes	yes
FL3S	Other	llenya, pellets, electricitat i ocasionalment - butà	0		>4	diversos variats	Yes	3 different brands	27	14.5	2.1A	Ordis	Yes	6	Yes	4	No						yes
FL4S	Heat pump		1	MITSUBISHI PEHD3	0		Yes	JUNKERS ELACELL ES150	4800	###	2.0 DHA	BARCELONA	No		No		No						yes
FL5S	Heat pump		1	DAIKIN TXG20LW	0		Yes	Nilo 150	2000	4.4	2.0A	Molins de Rei	Yes	3.2	Yes	2	No						yes
FL6S	Other	Principalm ent estufa catalítica, segona opció bombes de calor	3	Kosner (1-KSTI-12D/2-KSTI 12V/3-KSTI 18V)			Yes	Greenheiss, serie Standard 150.		4.60	2.0A	Cardedeu	No		No		No						yes
FL7S	Heat pump		>3	No ho sé, en parlem ;)			Yes			8.05	2.0 DHA	Parlavà	No		No		No						yes
FL8S	Heat pump		3	Daikin 3x1 3MXM40N	1	Orbegozo turbo 2000W	Yes	Nuos Evo 80 WH aerothermic	6500	4.6	2.0 DHS	El Bruc	No		No		Yes	ZOE40	28000	Sí	Const ruit per mi, varia	yes	yes



																					ble entre 10 i 20A		
FL9S	Heat pump		##	Daikin. Unitats interiors per conductes			Yes	Junkers. 200 litres	3300.17	5.75	2.0 DHA	Mataró	Yes	0.50	No		No						yes
FL10S	Electric radiators				>4	Ducasa digital	Yes	Tropik			2.1 DHA	Vilobí del Penedès	No		No		No						yes
FL11S	Electric radiators				2	Un és d'oli i l'altre és de Rointe (amb control digital)	Yes	Thermor	3676	3.3	2.0A	Vilassar de Mar	Yes	245	No		No						yes
FL12S	Heat pump		1	Panasonic Aquarea (central aigua calenta, calefacció i refrigeració per aigua i radiadors)	>4	Aquarea Air (combinats amb el sistema de bomba de calor; edollats per a automatisme i programació i circulació de l'aire i repartiment per ventil·lador.	Yes	Panasonic Aquarea (integrat en la bomba de calor central)	10000	4.6	2.0 DHA	Caldes de Malavella	Yes	###	No		No						yes
FL13S	Heat pump		1	Rotex	0		Yes	He puesto que si, pero en realidad la bomba de calor da ACS y calefacción/refrigeración	8000	4.6	2.0 DHA	Barcelona	No		Yes	2	No						yes
FL14S	Other	Terra radiant amb aigua escalfada amb caldera de condensació	0		0		Yes	Termo TEKA SLIM 80	1565	3.45	2.0 DHA	Sabadell	Yes	1.5	No		No						yes

		ó de gas natural																					
FL15 S	Electric radiators				1	Orbegozo RRM 1810	Yes	Thermor Steatite	1.699	4.6	2.0A	Salt	No		No		No						yes
FL16 S	Other	Aigua calenta sanitària mitjançant electricitat i 3 bombes de calor disponibles en habitacions concretes si escauen.	3	Daikin Siesta (les 3)	0		No		3824	5.75	2.0 DHA	Terrassa	No		No		No						yes
FL17 S	Heat pump		Més de 3	Lg c12awm		Marca blanca	Yes	50 litres		6.6	2.0A	Barcelona	No		No		No						yes
FL18 S	Heat pump		1	TCL Inverter	1	ENTO	No		656	###	2.0 DHA	Barcelona	No		No		No						yes
FL19 S	Heat pump		2	Kosner	0		No		1800	2.3	2.0 DHA	Barcelona	No		No		No						yes
FL20 S	Other	Terra radiant	0		0		Yes		12363	15		Sant Cugat del Vallès	No		No		No						yes
FL21 S	Other	BIOMASSA	0		0		Yes	SOLAR FOTOVOLTAÏC + RECOLZAMENT BIOMASSA	2500	3.46	2.0 DHA	SANT ANTONI DE VILAMAJOR	Yes	1	No		No						yes
FL22 S	Other	Xemeneia amb doble tub que porta aire calent amb un petit ventilador					Yes	Fagor 50N3		3.45	2.0A	Mediona	No		No		No						yes

FL23 S	Other	Terra radiant amb gas propà i estufa de pelet					Yes	Fleck - Nilo 2.0 75		4.4	2.0A	Santa Fedel Penedès	Yes	2.75	Yes		No						yes
FL24 S	Heat pump			Panasonic WH-SDC16C6E5			No			8.05	2.0 DHA	Roda de Ter	No		No		No					yes	
FL25 S	Other	sol radiant elèctric	0		0		Yes	Thermor GV ACI TEC 100 litres vertical	4811	###	2.1 DHA	Calella	No		No		No					yes	
FL26 S	Radia dors elèctrics				>4	Thermotech nic (4); Haverland (2); Rointe (1)	Yes	Vaillant eloSTOR pro	9266	4.4	2.0A	Castellví de la Marca	No		No		No					yes	
FL27 S	Altres	Gas natural pero usamos en primavera y otoño la bomba de calor	3	Mitshubitsi	1	Bluesky	No		5.066	4.4	2.0A	Sant Cugat del Vallés	No		No		No					yes	