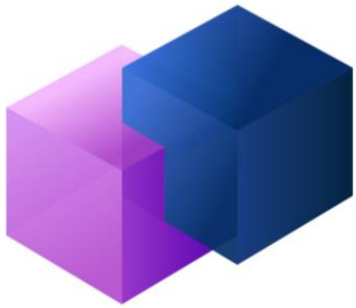
The PARITY project has received funding from the EU's Horizon 2020
research and innovation programme under grant agreement No 864319



Project Acronym:	**PARITY**
Project Full Title:	**Pro-sumer AwaRe, Transactive Markets for Valorization of Distributed flexibilITY enabled by Smart Energy Contracts**
Grant Agreement:	**846319**
Project Duration:	**42 months (01/10/2019 – 31/03/2023)**

DELIVERABLE D8.3

Report on preparation and hardware equipment installations in pilot sites

Work Package:	**WP8 – System Integration, Demonstration and Impact Assessment**
Task:	**T8.3 – Procurement of hardware infrastructure and deployment / integration in pilot sites**
Document Status:	**Final v1.0**
File Name:	**PARITY_D8.3_Report on preparation and hardware equipment installations in pilot sites_R1_V1_CUERVA**
Due Date:	**December 2021**
Submission Date:	**March 2022**
Lead Beneficiary:	**CUERVA**

Dissemination Level	
Public	X
Confidential, only for members of the Consortium (including the Commission Services)	

The PARITY project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 864319

Authors List

Leading Author				
First Name		Last Name	Beneficiary	Contact e-mail
Pablo		Blázquez	CUERVA	pblazquezm@cuervaenergia.com
Co-Author(s)				
#	First Name	Last Name	Beneficiary	Contact e-mail
1	Jorge	Rueda	CUERVA	jruedaq@cuervaenergia.com
2	Pablo	Lopez	CUERVA	plopez@cuervaenergia.com
3	Yannis	Syrimpeis	HYPERTECH	y.syrimpeis@hypertech.gr
4	Kostas	Kompos	HYPERTECH	k.kompos@hypertech.gr
5	Daniele	Farrace	AEM	dfarrace@aemsa.ch
6	Iulia	Minda	E.ON	iulia.minda@eon.seiulia.minda@gmail.com
7	Mikael	Hinsell	E.ON	mikael.hinsell@eon.se
8	Hamza	Shafique	CWATT	hamza.shafique@checkwatt.se
9	Javier	Ballestin	CIRCE	jballestin@fcirce.es
10	Stylianos	Zikos	CERTH	szikos@iti.gr
11	Lucia	Garin	URBENER	lucia.garin@urbener.com
12	Efstathia	Villiou	BFS	evilliou@nrg.gr

Reviewers List

Reviewers			
First Name	Last Name	Beneficiary	Contact e-mail
Davide	Rivola	HIVE	davide.rivola@hivepower.tech
Marco	Derboni	SUPSI	Marco.derboni@idsia.ch

Version History

Version	Author	Date	Status
0.1	Jorge Rueda Quintanilla, CUERVA	April 28, 2021	Initial draft (TOC)
0.7	Pablo Blázquez Martín CUERVA	February 18, 2022	First inputs from partners were added
0.8	Pablo Blázquez Martín CUERVA	February 22, 2022	Additional inputs from partners were added
0.9	Pablo Blázquez Martín CUERVA	March 3, 2022	Final draft for internal review
1.0	Pablo Blázquez Martín CUERVA	March 14, 2022	Final version including comments from partners, ready for submission

Legal Disclaimer

The PARITY project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 864319. The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the Innovation and Networks Executive Agency (INEA) or the European Commission (EC). INEA or the EC are not responsible for any use that may be made of the information contained therein.

Copyright

Executive Summary

This document presents the different works carried out by the pilot partners within task T8.3. In particular, all information gathered from the pilot partners regarding the procurement, deployment and commissioning of the PARITY equipment, is presented in this report.

The involved pilot partners are located in Spain, Greece, Switzerland and Sweden, and the equipment has been deployed in different environments, such us office headquarters (Spanish demo), office buildings and residential buildings (Spanish, Greek, Swedish and Swiss demo).

In this document, all the information related with procurement timeplan is presented as Gantt diagrams. Moreover, the deployment, installation and commissioning activities that took place are described, along with the required material specified in 'Bill of Materials' lists. When needed, a manual for the configuration and installation of certain equipment was provided to pilot partners, and the related information is also presented in this document.

Finally, the pilot partners provide a brief explanation of the lessons learnt after the implementation of the aforementioned activities.

Table of Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

Term	Description
AC	Air-conditioning
ANM	Active Network Management
API	Application Programming Interface
AS	Ancillary Services (market)
BLE	Bluetooth Low Energy
BMS	Battery Management System
BoM	Bill of Materials
DER	Distributed Energy Resources
DGs	Distribution Grids
DHW	Domestic Hot Water
DIY	Do it yourself
DSO	Distribution System Operator
D-STATCOM	Distribution Static Synchronous Compensator
EMS	Energy Management System
EV	Electric Vehicle
HVAC	Heating Ventilation Air-conditioning
IML	Information Management Layer
IoT	Internet of Things
LEM	Local Energy Market
LEMO	Local Energy Market Operator
LFC	Load Flow Calculation
LFM	Local Flexibility Market
LFMO	Local Flexibility Market Operator
LV	Low Voltage
MV	Medium Voltage
OCPP	Open Charge Point Protocol
P2P	Peer-to-Peer
PV	Photovoltaic
Q&A	Questions & Answers
SGM	Smart Grid Monitoring
TSO	Transmission System Operator
VPP	Virtual Power Plant
WS	Wholesale (market)

1. INTRODUCTION

1.1 Scope and objectives of the deliverable

This document presents the different actions of PARITY partners involved in the deployment and installation of pilots and pre-pilots in the field and contains a description of the time and materials of execution, installation, and commissioning, which has been carried out at sites in Spain, Greece, Sweden and Switzerland. For each of these sites, an overview of the current status and planned next steps is given.

1.2 Structure of the deliverable

This document consists of seven main chapters, the first of them is dedicated to the introduction of this document, from chapter 2 to 5 it describes the bulk of WP8, from the definition of responsibilities to the installation and commissioning of the equipment, chapter 6 for the knowledge obtained by each of the WP members and finally chapter 7 for conclusions.

As an overview of chapters 2 to 5, the following is detailed in them:

- Chapter 2 refers to the definition of key roles and responsibilities of the pilot deployment.
- Chapter 3 is dedicated to the presentation of the time plan for the deployment process and the related activities for each location.
- Chapter 4 details the pilot-specific procurement, including a BoM, and specifies the regulatory and organizational framework related to the procurement process. Also, definition of additional equipment is provided.
- Chapter 5 provides the installations' description and commissioning, including training activities featuring workshops introducing Hypertech's installation.

1.3 Relation to Other Tasks and Deliverables

The most relevant PARITY tasks and deliverables that were utilised as inputs are the following:

- T3.1 – *Elicitation and analysis of business/use cases and requirements for the PARITY tool suite* and the resulting deliverable D3.1 – *PARITY Business use cases & Requirements*
- T3.2 – *Ex-ante surveys of pilot infrastructure & equipment installation planning* and the resulting deliverable D3.2 – *Report on pilot sites infrastructure & upgrade plan*
- T7.1 – *PARITY IoT framework & prosumer services*

The outcomes of the work for the equipment installations that is described in this deliverable will be essential for fulfilling the objectives of all the other tasks in WP8. The directly impacted tasks of WP8 concern the system integration, pre-validation activities and demonstration in the four pilot sites, and are listed below.

- T8.1 – *PARITY System Integration*
- T8.4 – *Pre-validation activities*
- T8.5 – *PARITY system roll-out and demonstration in 4 pilot sites*

2. DEFINITION OF KEY ROLES & RESPONSIBILITIES WITHIN THE PILOT DEPLOYMENTS

2.1 Roles & responsibilities definition

Four different personnel key roles have been identified for the pilot deployments. These are the Technical director, the Pilot director, the Commissioner, and the Technician role. The responsibilities and expected competences of each role are presented next.

Technical director

The technical director is responsible for providing the necessary tools, training, and support for the IoT infrastructure deployment on all pilot sites.

- Training activities
- Plan & Guidelines of Pilot installations
- Tools provisioning
- 2nd level technical support

The expected competences of the technical director are the following:

- Excellent knowledge of technical solution
- Familiar with relevant technical projects
- Good knowledge of hardware and software
- Teaching/training skills
- Ability to support technical teams

Pilot director

The pilot director is responsible for organising, managing and reporting on the pilot deployment and operations activities.

- End-user communication & engagement
- Local Assignments & Installation process management
- Manages deployment work plan progress & Operations
- Reporting to the project / EU

The required skills of the pilot director are defined as:

- Basic understanding of technical aspects
- Good understanding of the deployed system
- Good management skills
- Good in communication and public relations
- Familiar with pilot projects
- Ability to manage and control groups of technicians

Commissioner

The commissioner is responsible for the **on-site** installation/commissioning process and local (1st level) technical support.

- Execution of installations/ commissioning plan
- Monitoring of Infrastructure Health and operations
- End-user orientation regarding the installed system
- 1st level technical support

The expected competences of the commissioner are the following:

- Training on device installations
- First level knowledge on system configuration and software setups
- Basic knowledge on electric circuits and networking
- Strong technical skills
- Good understanding of the collected data
- Good in public relations
- Adequate English knowledge

Technician

Certified technicians are responsible for the hard installation of the metering devices on-site (can also be an externally contracted party) under the Commissioner supervision.

- Local Hard Installations (Electrical, Network)

The expected competences of the technicians are the following:

- Certificate of professional competence
- Adequate English knowledge

3. PILOT-SPECIFIC DEPLOYMENT TIME PLAN

3.1 Deployment time plan for the Spanish demo

3.1.1 Granada demo

The project pilot located in the Granada demo-site includes the installation of a D-STATCOM prototype for balancing the low voltage network. The development of this device is being carried out in T6.2, thus, the deployment time plan is conditional on this task. Next, the Gantt diagram shown in Figure 1 draws the schedule expected for the Granada demo deployment.

	Subtask	sep.-21	oct.-21	nov.-21	dec.-21	jan.-22	feb.-22	mar.-22	apr.-22	may.-22	jun.-22	jul.-22
		M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34
WP6	Manufacturing											
	Laboratory test											
WP8	Shipment											
	Deployment											
	Commissioning											
	Field tests											

Figure 1: Deployment Gantt diagram

3.1.2 Zaragoza demo

The pilot plants located in Zaragoza, which are the Urbener offices, Acesa building and CIRCE facilities will be used for the collection of real-time consumption data for subsequent study to offer flexibility solutions in Parity. The following Gantt diagrams show the development of URBENER offices and ACESA building pilot plants and the expected future.

	may.-21	jun.-21	jul.-21	aug.-21	sep.-21	oct.-21	nov.-21	dec.-21	jan.-22
	M20	M21	M22	M23	M24	M25	M26	M27	M28
BoM									
Budget									
Shipment									
Installation									
Commissioning									
Test									

Figure 2: Urbener headquarters Gantt diagram

	jul.-21	aug.-21	sep.-21	oct.-21	nov.-21	dec.-21	jan.-22	feb.-22	mar.-22
	M22	M23	M24	M25	M26	M27	M28	M29	M30
BoM									
Budget									
Shipment									
Installation									
Commissioning									
Test									

Figure 3: Acesa building Gantt diagram

The installation of control and monitoring equipment in CIRCE facilities is almost finished, remaining only the photovoltaic installation and some minor changes in the communications infrastructure. These activities will end within the schedule of T8.3. When the equipment will be correctly installed and their communications checked, integration with PARITY systems and preparations for demonstration phase corresponding to T8.1 and T8.5 will be carried out.

	jul.-21	aug.-21	sep.-21	oct.-21	nov.-21	dec.-21	jan.-22	feb.-22	mar.-22
	M22	M23	M24	M25	M26	M27	M28	M29	M30
Installation									
Comissioning									
Test									

Figure 4: CIRCE facilities Gantt diagram

3.2 Deployment time plan for the Greek demo

For the Greek demo site, the activities for the creation of the Bill of Materials (BoM) and the deployment plans started in M25 and had a duration of almost 4,5 months, following the on-site audits and the communication with the end-users. From M29 to M31, all activities relevant to the procurement of the equipment, the training and the installation/commissioning will take place. The pilot deployment and working period will last for one year, from M31 to M42.

It is important to mention that given the number of residential pilots, successive activities are running smoothly, to ensure that once the BoM is prepared, the respective equipment can be procured.

Activities	oct.-21	nov.-21	dec.-21	jan.-22	feb.-22	mar.-22	apr.-22	may.-22	jun.-22	jul.-22	aug.-22	sep.-22	oct.-22	nov.-22	dec.-22	jan.-23	feb.-23	mar.-23
	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34	M35	M36	M37	M38	M39	M40	M41	M42
BoM & Deployment Plan Creation																		
Material & Services Procurement																		
Training Activities																		
Installation & Commissioning																		
Pilot deployment and working period																		

Figure 5: Deployment time plan for the Greek demo

Finally, for the Greek demo cases pre-validation activities were performed in the nZEB - DIH test bed of CERTH, and the Hypertech office premises

3.3 Deployment time plan for the Swiss demo

The detailed end-to-end deployment time plan for the Swiss pilot site is shown in the table below.

Activity	Partner	sep.-21	oct.-21	nov.-21	dec.-21	jan.-22	feb.-22	mar.-22
		M24	M25	M26	M27	M28	M29	M30
Creation of (early) deployment plans	HYP							
BoMs preparation	HYP							
Procurement equipment	AEM							
Procurement equipment w/ delays	AEM							
Procurement other services	AEM							
Commissioning	AEM							
Commissioning w/ delay	AEM							
Commissioning training	HYP							
1st level support training	HYP							

Figure 6: Deployment time plan for the Swiss pilot site

An explanation of the deployment timeline follows:

- Activity ID0 concerns the creation of the early deployment plans for pre-validation activities and of the actual deployment plans. This activity is completed, the detailed deployment plans for residential users (AEM006, AEM008, AEM014, AEM017) and the Municipality are attached in the Annex II.
- Activity ID1 is completed.
- Activity ID2 and ID5 are partially completed, all the necessary equipment has been ordered and, where possible, commissioned. Please see ID3 for procurement delays.
- Activities ID3 and ID6 refer to delays in the delivery of the Raspberry PI devices by the supplier, due to global semiconductor shortages. The timeline shows the best estimation based on supplier indications.
- Activity ID4 refers to the configuration of the necessary hardware to allow internet communication for user AEM005.
- Activities ID7 and ID8 are completed.

As part of the early deployment for sites involved in the pre-validation activities, which includes residential users AEM006, AEM014, and the Municipality building, the time plan is shown below.

Activity	Partner	sep.-21	oct.-21	nov.-21	dec.-21	jan.-22	feb.-22	mar.-22
		M24	M25	M26	M27	M28	M29	M30
BoM preparation	HYP							
Procurement equipment	AEM							
Installation and commissioning	AEM							
Intesis devices connectivity tests	AEM							
Pre-validation activities	HYP							

Figure 7: Detailed time plan for the early deployment

All the work for the BoM creation, procurement, installation and commissioning, and connectivity tests for the early-deployment has been completed by M27. Pre-validation activities conducted by HYP started in M26 and continue until the end of the Work Package.

3.4 Deployment time plan for the Swedish demo

The table below contains a detailed time plan of all the activities conducted towards the system deployment at the Swedish pilot site. Each longer activity is assigned a period over which it occurred, while month long activities are pinpointed to specific months.

Activity	jan.-21	feb.-21	mar.-21	apr.-21	may.-21	jun.-21	jul.-21	aug.-21	sep.-21	oct.-21	nov.-21	dec.-21	jan.-22	feb.-22	mar.-22
	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
Creation of BoM (first version)															
Creation of BoM (second version)															
Procurement of hardware															
Procurement of materials															
Procurement of specialised services															
Frequency Regulation pre-qualification for VPP															
Training activities															
Installation at residential pilot															
Installation at commercial pilot															
Integration of Frequency Regulation biding service with E.ON trading															

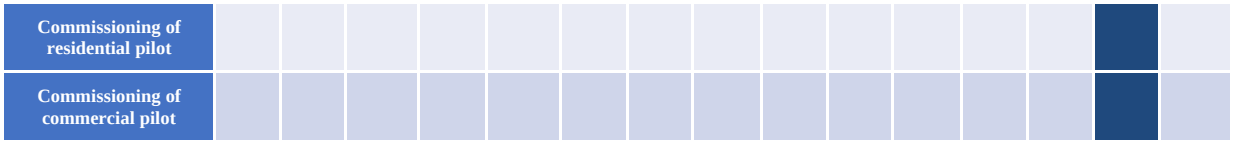


Figure 8: Deployment time plan for the Swedish demo

Comments are given concerning some activities presented in Figure 8:

Creation of BoM (first version)

- Only including hardware related battery system components (stationary batteries and power converters)

Creation of BoM (second version)

- Materials related to the electrical installation of the battery systems

Procurement of hardware

- Materials related to the electrical installation of battery systems

Procurement of specialised services

- Fire safety surveying and reporting
- Specialist electrical installation and related services
- Commissioning services provided by battery and power converter manufacturers

Frequency Regulation pre-qualification for VPP

- Process started with the Swedish TSO.
- System validation complete
- Pending: Battery supplier to troubleshoot some problems

Integration of Frequency Regulation biding service with E.ON trading

- Communication protocols acquired
- Validation once prequalification is complete

4. PILOT-SPECIFIC PROCUREMENT SPECIFICATIONS

4.1 Spanish demo-site

4.1.1 BoM definition

Definition on BoM based on outcomes of T3.2 & the equipment defined in T7.1.

4.1.1.1 IoT equipment

In regards to the human-centric building automation developed within PARITY, two large commercial buildings hosting the company offices of URBENER and ACESA were selected for the project demonstration activities in Spain. The two sites comprised small offices, regularly occupied by 1-3 users, and meeting rooms. In both cases, the electricity-based infrastructure available on site included air-to-air heat pumps primarily used for cooling purposes, small on-demand water heaters and lighting systems. After a thorough assessment of the existing infrastructure, only the air-to-air heat pumps were selected for remote control, while the lighting and DHW loads were discarded due to the age of the existing infrastructure, and its small capacity.

The IoT devices included in the Bills of Materials created for the commercial buildings of the Spanish pilot were selected from the equipment list generated in T7.1 and, as discussed in the relevant deliverable, were extensively tested before their installation on site. The deployed IoT topology included energy meters for the HVAC loads and total building consumption, multisensors for monitoring the indoor ambient conditions and occupancy of the buildings, and dedicated devices for monitoring and controlling the operational status of the HVAC devices, transforming them from legacy to smart systems. At each building, a Raspberry Pi 4 was installed to host the PARITY gateway. Table 1 summarises the IoT devices selected for the Spanish pilot, based on the list presented in D7.1 [1]. It is worth noting that for the more sensitive and fault prone devices, such as the SD cards used to expand the Raspberry Pi storage, some spare devices were also included in case of malfunction during the deployment or the operation period.

Table 1: Spanish pilot BoM (commercial)

PARITY IoT gateway	
Description	**Quantity**
Raspberry Pi 4 Model B 2GB	2
Official Raspberry Pi 4 Model B Red & White Case	2
Raspberry Pi 4 Official Power Supply 5.1V 3.0A (White)	2
Z-Wave Z-Wave. Me RaZberry 2 Module	2
Samsung Pro Endurance microSDHC 32GB U1 with Adapter	3
Aeotec Range Extender 7 - EU Socket	1
Consumption Monitoring	
Description	**Quantity**
Z-Wave Plus Aeotec Clamp Power Meter - Three Clamps (60A)	2
Ambient Sensing and Occupancy Sensing	
Description	**Quantity**
Aeon Labs Multisensor 6 - Z-Wave Plus (Temperature - Humidity - Light Sensor - Presence)	14
5V USB Power Supply	14
HVAC System - Consumption Monitoring	
Description	**Quantity**
Z-Wave Plus Aeotec Clamp Power Meter - Three Clamps (60A)	3

HVAC System - Status Monitoring / Control	
Description	**Quantity**
Fujitsu RAC and VRF systems to WiFi (ASCII) Interface (to remote controller) (INWMPFGL001R000)	3
Universal IR Air Conditioner to Home Automation Interface (INWMPUNI001I000)	1
Hitachi VRF systems to Modbus TCP/RTU or HA Interface (INMBSHIT016O000)	1

4.1.1.2 Additional Equipment definition

The main equipment to deploy in the Granada pilot-site consist of the D-STATCOM and the auxiliary devices to ensure its proper operation and safety.

The D-STATCOM prototype, shown in Figure 9, consist in a metallic cabinet which includes the power electronics, filters, control and communication components necessary for the operation of the device, allowing the DSO toolset a complete remote monitoring and control over the device.

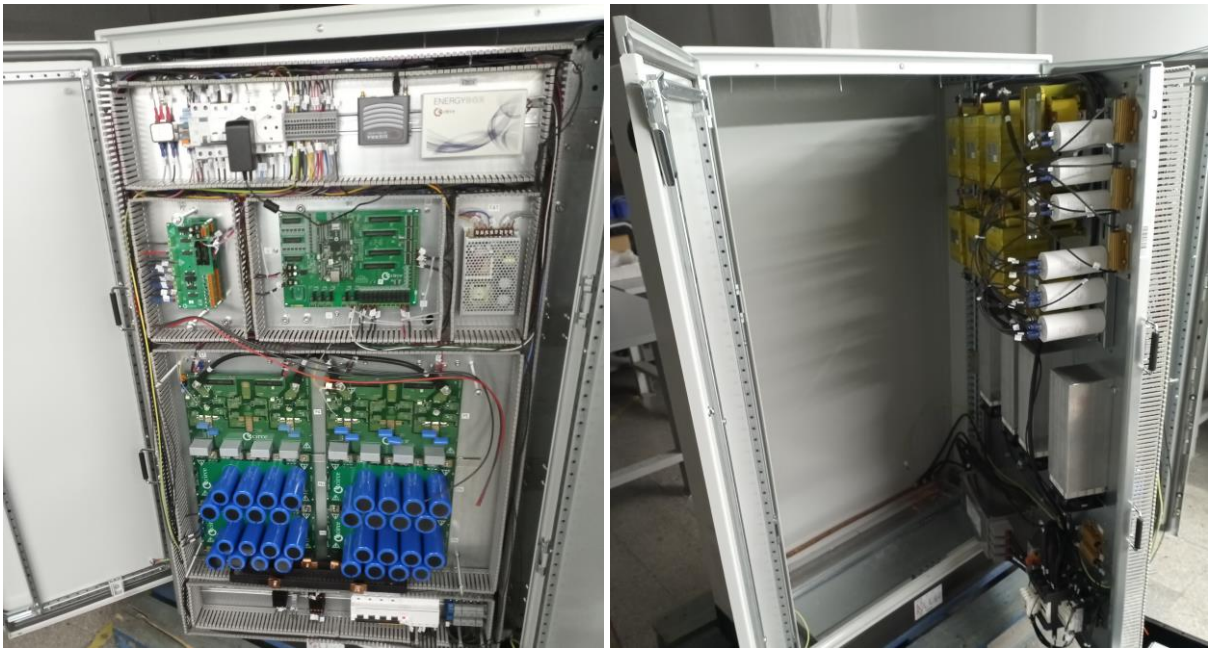


Figure 9: D-STATCOM front view (left) and back side of the mountain plate.

In addition, some components that must be installed outside of the D-STATCOM enclosure are defined below:

- Current sensors: to allow the autonomous operation of the prototype, three current sensors should be installed to measure the three currents in the line. The final model of the sensors will be chosen according to the maximum current of the line where the D-STATCOM will be installed.
- Switch-disconnector: to guarantee safety during maintenance tasks it is recommended the installation of a switch-disconnector to ensure the de-energization of the device before its handling. This device does not require any special features as the opening will always take place under no-load conditions.
- Fuses: despite the prototype includes thermal-magnetic and residual-current circuit breakers, it is recommended to install fuses in the three phases and the neutral wire of the prototype derivation. Its rated current must be around 100 A.

4.1.2 Procurement

4.1.2.1 Granada demo

The D-STATCOM has been designed and manufactured by CIRCE.

4.1.2.2 Zaragoza demo

Urbener Headquarters

The materials needed for this pilot plant are those included in the Urbener BoM made by Hypertech (Table 1).

For the purchase and installation of the devices, a company of installers from Zaragoza, EIMER electrificaciones, was contracted. Once the installation was finished, the devices were put into operation following Hypertech's indications.

Acesa building

The materials needed for this pilot plant are those included in the Acesa Building BoM made by Hypertech (Table 1).

EIMER is also contracted for the purchase and installation of the devices. Due to the microchip crisis in China, the shipment of the devices has been delayed.

4.2 Greek demo-site

4.2.1 BoM definition

Definition on BoM based on outcomes of T3.2 & the equipment defined in T7.1.

4.2.1.1 IoT equipment

PARITY's control automation system was planned to be demonstrated at the Greek pilot in commercial and residential environments including a wider range of loads. In both cases, the IoT devices included in the respective BoMs were selected from the equipment list defined in T7.1 and Raspberry Pi's were installed at each prosumer premises to host the PARITY gateway.

For the commercial demo site, a group of small offices hosting 1-2 regular occupants and a meeting room were selected, offering the possibility of lighting control and HVAC control, and more specifically AC split units. The deployed IoT topology consisted of energy meters for the total building consumption and AC consumption metering, multisensors for monitoring the indoor ambient conditions and occupancy of the buildings, smart switches for the lighting control and dedicated devices for monitoring and controlling the operational status of the individual HVAC units. Table 2 summarises the IoT devices selected for the commercial installations, based on the list presented in D7.1 [1].

Table 2: Greek pilot BoM (commercial)

PARITY IoT gateway	
Description	**Quantity**
Raspberry Pi 4 Model B 2GB	1
Official Raspberry Pi 4 Model B Red & White Case	1
Raspberry Pi 4 Official Power Supply 5.1V 3.0A (White)	1
Z-Wave Z-Wave. Me RaZberry 2 Module	1
Samsung Pro Endurance microSDHC 32GB U1 with Adapter	1
Consumption Monitoring	
Description	**Quantity**
Z-Wave Plus Aeotec Clamp Power Meter - Three Clamps (60A)	1
Ambient Sensing and Occupancy Sensing	
Description	**Quantity**
Aeon Labs Multisensor 6 - Z-Wave Plus (Temperature - Humidity - Light Sensor - Presence)	6
5V USB Power Supply	6
HVAC System - Consumption Monitoring	
Description	**Quantity**
Z-Wave Plus Aeotec Clamp Power Meter - Three Clamps (60A)	4
HVAC System - Status Monitoring / Control	
Description	**Quantity**
Universal IR Air Conditioner to Home Automation Interface (INWMPUNI001I000)	4
Smart lighting control	
Description	**Quantity**
Fibaro Double Switch 2	4

For the residential demo site, the dwellings that were selected include apartments, detached and semidetached houses. Among the available electric loads selected for the demonstration of the PARITY solution were AC split units, electric radiators and electric water heaters. The deployed IoT topology included energy meters, smart plugs, smart switches, multisensors and devices for monitoring and controlling the operational status of the individual HVAC units. It is worth noting that in individual cases already available IoT devices, compatible with PARITY's system, were utilized for the demonstration needs. Table 3 summarises the IoT devices selected for the residential installations, based on the list presented in D7.1 [1].

Table 3: Greek pilot BoM (residential)

PARITY IoT gateway	
Description	**Quantity**
Raspberry Pi 4 Model B 2GB	35
Official Raspberry Pi 4 Model B Red & White Case	35
Raspberry Pi 4 Official Power Supply 5.1V 3.0A (White)	35
Z-Wave Z-Wave. Me RaZberry 2 Module	35
Samsung Pro Endurance microSDHC 32GB U1 with Adapter	35
Aeotec Range Extender 7 - EU Socket	2

Consumption Monitoring	
Description	**Quantity**
Shelly EM (50A Clamp)	16
Shelly 2.5/EM DIN bracket	16
Z-Wave Qubino Smart Meter ZMNHTD1 Plus	6
Z-Wave Plus Aeotec Clamp Power Meter - Three Clamps (60A)	13
Ambient Sensing and Occupancy Sensing	
Description	**Quantity**
Aeon Labs Multisensor 6 - Z-Wave Plus (Temperature - Humidity - Light Sensor - Presence)	48
5V USB Power Supply	48
HVAC System - Consumption Monitoring	
Description	**Quantity**
Qubino Smart Plug 16A	32
Shelly EM (50A Clamp)	7
Shelly 2.5/EM DIN bracket	7
HVAC System - Status Monitoring / Control	
Description	**Quantity**
Universal IR Air Conditioner to Home Automation Interface (INWMPUNI001I000)	39
DHW System - Consumption Monitoring / Control	
Description	**Quantity**
ICT 2NO contact	32
Z-Wave Qubino Smart Meter ZMNHTD1 Plus	3
Shelly EM (50A Clamp)	25
Shelly 2.5/EM DIN bracket	25

Additional Equipment definition

Connectivity with the EV charging stations

Regarding the deployment of the EV Profiling and Smart Charging component and its communication with the EV charging stations of the pilot site, two different options were proposed and presented to the participating partners. These are the following:

1. To use a dedicated Open Charge Point Protocol (OCPP) server controlled by the EV Profiling and Smart Charging component. The OCPP client of the EV charging station communicates with the OCPP server. PARITY EV Profiling and Smart Charging component communicates with the OCPP server to acquire current measurements/events or send control signals.
2. To use already existing EV management platform of the pilot site. In this case, data exchange with the EV charging stations is performed via an external API that is provided by the manufacturer (such as a HTTP REST API), while OCPP protocol is only utilized internally by the EV management platform. EV Profiling and Smart Charging component can utilise the API for implementing the communication with the EV charging stations. Eventually, data from EV charging stations will be stored as events to the LEM/LFM Repository.

It shall be mentioned that for both options, a processing step is needed to convert the format of the messages according to the common JSON data formats that were defined.

After internal discussions with BFS and assessment of the current state at the pilot, it was determined that the first option is not feasible for the Greek demo site, as EV charging stations were already in use and connected to manufacturer's EV management platform. Therefore, the second option is selected and the details for the integration will be specified in cooperation with BFS. Apart from performing the proper network configurations, no special equipment had to be procured to facilitate the EV charging functionalities.

4.2.2 Procurement

The objective of the procurement is to obtain and install all the necessary devices and off-the-shelf equipment at all pilot and pre-pilot sites. To carry out these activities, BFS, following the bill of materials, has procured all the equipment described above and contracted the services of an in-house electrician.

Up to date no constraints are foreseen due to the regulatory framework and organisational constrains, as BFS has established an easy and flexible procedure for equipment and services procurement. Moreover, there are various do-it-yourself actions, which minimise the procurement of specialised services which can be complicated.

Nevertheless, it is possible that several delays occur to the procurement of Raspberry-Pi boards due to the shortages by the manufacturers, heavily impacted by the pandemic. To tackle this challenge, the whole consortium and specifically the technical partners are monitoring the situation with the pilot partners.

4.3 Swiss demo-site

4.3.1 BoM definition

Definition on BoM based on outcomes of T3.2 & the equipment defined in T7.1.

4.3.1.1 IoT equipment

The third site to host PARITY's control automation system was the Swiss pilot. The IoT infrastructure defined for the planned demonstrations was deployed, as in the case of the Greek pilot, at both commercial and residential buildings. The respective BoMs were once more based on the list of proposed equipment documented in D7.1 [1] and Raspberry Pi's were installed at each prosumer premises to host the PARITY gateway and enable the seamless communication with the IoT devices.

For the commercial demo site, the entire second floor of the Tesserete municipality building comprising a group of small offices hosting 1-2 employees, and a meeting room was selected. The Tesserete building offered control over HVAC loads and more specifically, AC multi-split units systems. The infrastructure deployed on site included energy meters, multisensors and dedicated devices for the monitoring and control of the individual indoor AC units. Table 4 summarises the IoT devices selected for the commercial installations.

Table 4: Swiss pilot BoM (commercial)

PARITY IoT gateway	
Description	**Quantity**
Raspberry Pi 4 Model B 2GB	1
Official Raspberry Pi 4 Model B Red & White Case	1
Raspberry Pi 4 Official Power Supply 5.1V 3.0A (White)	1
Z-Wave Z-Wave. Me RaZberry 2 Module	1
Samsung Pro Endurance microSDHC 32GB U1 with Adapter	1
Aeotec Range Extender 7 - EU Socket	1

Ambient Sensing and Occupancy Sensing	
Description	**Quantity**
Aeon Labs Multisensor 6 - Z-Wave Plus (Temperature - Humidity - Light Sensor - Presence)	6
5V USB Power Supply	6
HVAC System - Consumption Monitoring	
Description	**Quantity**
Z-Wave Plus Aeotec Clamp Power Meter - Three Clamps (60A)	2
HVAC System - Status Monitoring / Control	
Description	**Quantity**
Universal IR Air Conditioner to Home Automation Interface (INWMPUNI001I000)	6

For the residential demo site, the dwellings selected included primarily detached and semidetached houses. To minimize nuisance for the users and towards adopting an economy-of-scale strategy, it was decided that for the PARITY demo activities, the existing HIVE infrastructure for metering and control, presented in the following section, would be utilized whenever possible. This substantially reduced the amount of equipment to be installed on site and subsequently the required deployment time. The available electric loads selected for the PARITY demonstration were air-to-water heat pumps and electric water heaters. The deployed IoT topology included energy meters, smart switches, and multisensors. In addition, dedicated cloud services linked to specific heat pump models, offering 3rd party APIs, were interfaced with the PARITY IML cloud in order to extract data and remotely control the device without using additional equipment. To establish internet connection, additional cabling and devices such as WiFi range extenders were used. However, it should be noted that such equipment is not reported in the current deliverable as their necessity was identified ad hoc upon the installation visit, and not through the pilot auditing process. Table 5 summarises the additional IoT devices selected for the residential installations, based on the list presented in D7.1 [1].

Table 5: Swiss pilot BoM (residential)

PARITY IoT gateway	
Description	**Quantity**
Raspberry Pi 4 Model B 2GB	5
Official Raspberry Pi 4 Model B Red & White Case	5
Raspberry Pi 4 Official Power Supply 5.1V 3.0A (White)	5
Z-Wave Z-Wave. Me RaZberry 2 Module	5
Samsung Pro Endurance microSDHC 32GB U1 with Adapter	5
Ambient Sensing and Occupancy Sensing	
Description	**Quantity**
Aeon Labs Multisensor 6 - Z-Wave Plus (Temperature - Humidity - Light Sensor - Presence)	1
5V USB Power Supply	1
DHW System - Consumption Monitoring	
Description	**Quantity**
Aeon Labs Multisensor 6 - Z-Wave Plus (Temperature - Humidity - Light Sensor - Presence)	4

4.3.1.2 Additional Equipment definition

Monitoring and control of heat pumps and/or electric boilers by means of the readily available HIVE infrastructure.

For 6 residential prosumers within the Swiss pilot site – namely AEM002, AEM007, AEM009, AEM012, AEM013, AEM018 – monitoring and controlling of heat pumps and/or electric boilers will be performed using the HIVE infrastructure, which is already installed in the respective premises.

HIVE infrastructure includes:

- Embedded industrial computing device
- Optical connection to the smart meter
- 4G connection module

and is installed next to the households' smart meters L&G E450 within the external electrical cabinet. No additional procurement is foreseen.

4.3.2 Procurement

For 4 residential users (AEM006, AEM008, AEM014, AEM017) IoT equipment such as sensors, energy meters, gateways is required according to the respective BoMs.

For AEM006 and AEM014 all the necessary IoT equipment has been already procured and commissioned, as part of the ongoing pre-validation activities of T8.4. For AEM008 and AEM017, the required equipment was procured, with the exception of the gateway (Raspberry PI), the delivery of which was delayed several times by the supplier due to the semiconductor shortage. AEM attempted to source from other suppliers, but this did not improve the situation due to a global supply chain issue. At the time of writing, delivery is expected by the end of M29. For installation and commissioning of the remaining gateways, AEM will require 1-3 weeks, depending on user needs.

For the commercial user of the Swiss pilot site (Municipality), all the necessary equipment as defined in the respective BoM has been already procured and commissioned. Pre-validation activities as part of T8.4 started in M26.

For residential user AEM005, an external internet connection is required, in order to allow a direct communication between the heat pump and the cloud, because the user's Wi-Fi signal is not sufficient. AEM is assessing effective alternatives to enable this connectivity. A solution is expected to be available and configured by end of M30. AEM also contacted the user's heat pump manufacturer to enable the basic functionality for cloud connectivity (free of charge), which will be configured after the external internet connection is established (M30).

4.4 Swedish demo-site

4.4.1 BoM definition

Definition on BoM based on outcomes of T3.2 & the equipment defined in T7.1.

DER (PV+Storage) Scheduling and Dispatch Prosumer Services – The adjusted prosumer application handling PARITY Stationary Battery module and PV Module output is planned to include the following elements:

- Past and forecasted PV gross production
- Comparative indicators showing PV installation performance rate
- Past and forecasted building level consumption
- Stationary battery capacity allocation between local use cases and external flexibility offers
- Past stationary battery activity and building level effects

In short, the prosumer application handling PARITY Stationary Battery module and PV Module output will cover a full spectrum of related data and ensure prosumer trust, enabling performance evaluation and pushing higher engagement and marketing opportunities.

4.4.1.1 IoT equipment

The Swedish demo-site was audited and investigated in great detail in order to assess its eligibility to participate in the demonstration activities of PARITY's smart building automation. However, due to a number of factors including the nature and usage of the sites available for the project demonstrations, as well as the loads available on site rendered the Swedish demo-site non eligible. More specifically, the majority of the commercial spaces examined for the project activities were public places with multiple and diverse visitors daily, inhibiting the system's profiling mechanism. In addition, the existence of centrally controlled, collective HVAC and DHW systems for both the commercial and residential sites eliminated the possibility of personalized control automation. Therefore, the focus of the Swedish demonstration activities was instead turned to the PV and BESS management systems, the equipment definition for which is presented in the following section.

4.4.1.2 Additional Equipment definition

The PV + Storage (Battery Management) System is made up of the following components:

PV – Photovoltaic installation made up of silicone based solar cells electrically connected to form panels and installed on the pilot site premises. Solar cells convert electromagnetic radiation from the sun into electrical energy

Solar inverter – electrical converter used to convert the direct current (DC) output of PVs into alternating current (AC)Stationary battery – electrochemical cells which have been electrically connected to supply a direct current and voltage when connected to an electrical load, operated in a permanent location

BMS – battery management system essential for managing battery charge and discharge, as well as provide a State of Charge (SoC)

Power converter – hybrid inverter / rectifier used between battery and power source / load

DC Fuse box – overload protection fuses on DC cables for stationary batteries and power converter

AC Fuse box – new section on the AC side for connecting the stationary battery system to the existing installation

PV Manager – The PV Manager monitors and controls the PV installation at the site. It performs PV generation forecast and monitors and controls the PV generation.

Stationary Batter Manager – The Stationary Battery Manager has the task of monitoring, forecasting, and operating the Battery. It performs a forecast on the peak shaving expectation and delivers the peak shaving service at the delivery time by correctly operating the battery. It also performs the real-time battery control for flexibility delivery at the predefined times.

4.4.2 Procurement

The procurement of materials has been divided into two distinct sections for the purpose of this document – hardware (including stationary batteries) and materials (related to the electrical installation of battery storage). Hardware components (batteries and power converters) were purchased via E.ON's internal procedures and existing procurement agreements with the hardware providers. Materials related to the electrical installation of the batteries were purchased by E.ON's linked third party EMG, also responsible

for the installation itself. Following installation, these materials were invoiced to E.ON. A possible organizational constraint arises when making high value purchases in that E.ON requires procurement agreements to be in place with the supplier in question. Such procurement agreements are to be drawn up according to E.ON's legal purchasing criteria.

The procurement of necessary accompanying services occurred via different processes, depending on the nature of the specialized service and the involvement of the service provider in the PARITY project. Installation services provided by EMG were arranged via their E.ON-linked third party participation in the project. Additional specialist installation services were invoiced to E.ON upon commissioning of pilot sites. Fire safety surveying and reporting was ordered via E.ON's existing procurement agreements.

5. INSTALLATIONS & COMMISSIONING ACTIVITIES

5.1 Introduction

Upon the successful completion of the procurement process per pilot, the PARITY system installation and commissioning activities were launched. For those pilots demonstrating the project's human-centric services, requiring the deployment of elaborated IoT equipment, a series of training activities were organized. These activities aimed to provide the involved partners with the necessary tools to deploy and support the installed IoT infrastructure throughout the project's duration. Namely, the Spanish, the Swiss, and the Greek pilot partners participated in the training activities described in the following section, 5.2. Sections 5.3, 5.4, 5.5, and 5.6 describe the specific installation and commissioning activities performed per site.

5.2 Training activities

Towards supporting and facilitating the deployment of the smart IoT infrastructure at the pilot sites of the project, a series of training activities were organized. Their aim was to introduce PARITY's IoT framework to the pilot partners of the project and to provide them with the necessary material to deploy and technically support the pilot installations. The training activities were designed to address all stages of the pilot demonstration, from installation and commissioning to maintenance and operation. The material created and distributed aimed at providing a comprehensive guide on the establishment of the pilot installations and the maintenance of their health and uninterrupted operation.

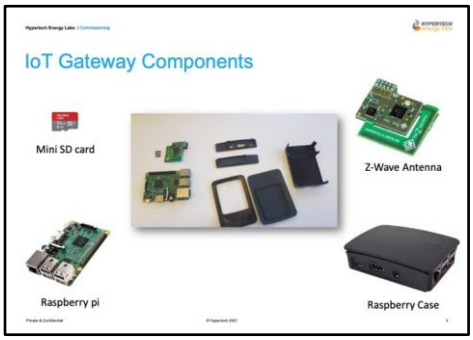
The activities were structured in two rounds of workshops:

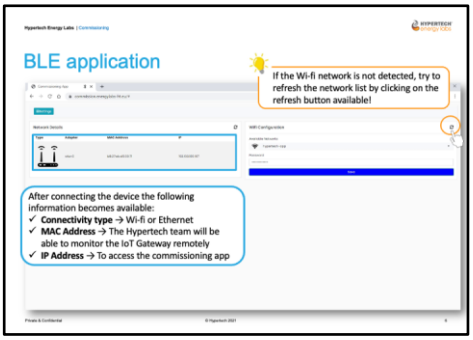
The installation and commissioning workshop

The first round comprised an introductory workshop introducing Hypertech's installation and commissioning process in a step-by-step approach. The workshop was structured in three sessions:

1. Presentation of the solution, the equipment, and the commissioning process, and discussion of the problems and mistakes frequently encountered during the system deployment,
2. Demonstration of the commissioning process through a DIY video,
3. Q&A session.

The installation and commissioning workshop was organised for all pilot directors and commissioners at the same time. It was planned when all installation details (BoMs, deployment plans etc) for all pilot sites were finalized but before the actual installation process was initiated for any of the pilot sites. During the installation and commissioning workshop, the pilot partners assuming the commissioner role had the opportunity to ask questions related to the deployment task at hand, and clarify any pilot-specific points. Additionally, through the commissioning demo video a realistic representation of the time required for the commissioning task was provided in order to more accurately plan the on-site visits.





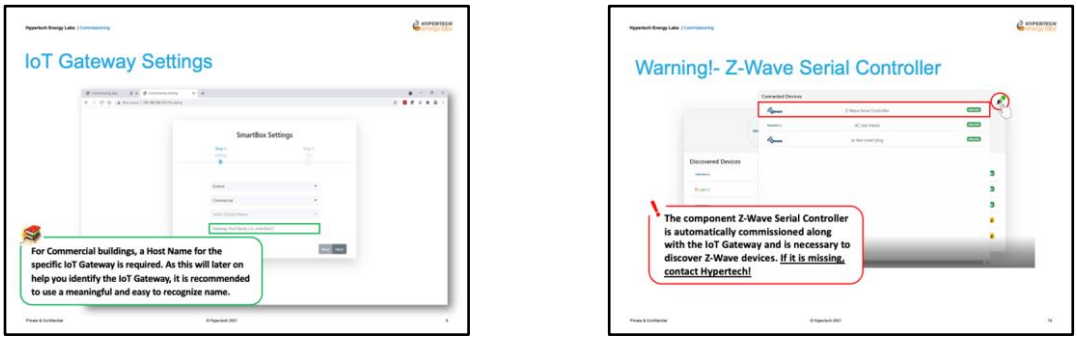


Figure 10: Slides from session 1 of the installation and commissioning workshop

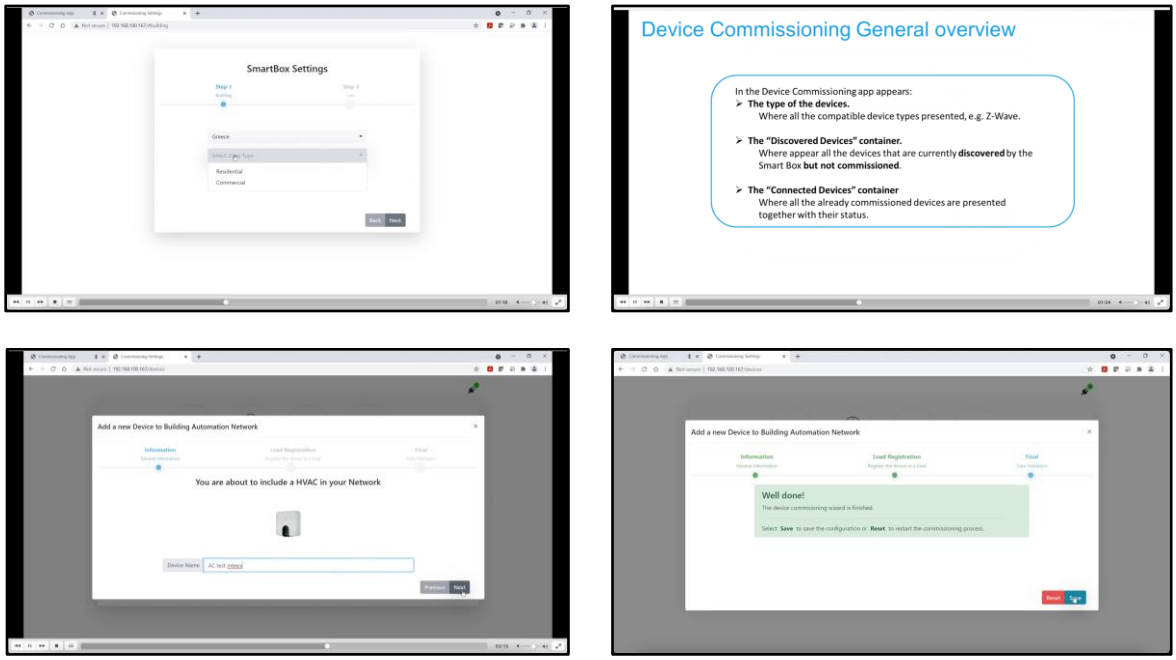


Figure 11: Video screenshots from session 2 of the installation and commissioning workshop

The monitoring and maintenance workshop

The second round of workshops was delivered to each pilot partner individually, as not all installations were completed at the same time. The deployment stage of each pilot depended on its size, procurement status, and whether it was planned to participate in PARITY's pre-validation activities (T8.4).
The second round workshops were again structured in three sessions:

(i) Presentation of the monitoring tool and introduction to the first level of support highlighting the most commonly encountered issues and actions to be taken to restore the installation health,
(ii) Introduction to the error reporting process through Gitlab[1],
(iii) Q&A session.

The monitoring and maintenance workshop was organised per pilot right after at least one installation was completed successfully, initiating the operation phase of the site.

[1] https://gitlab.com/

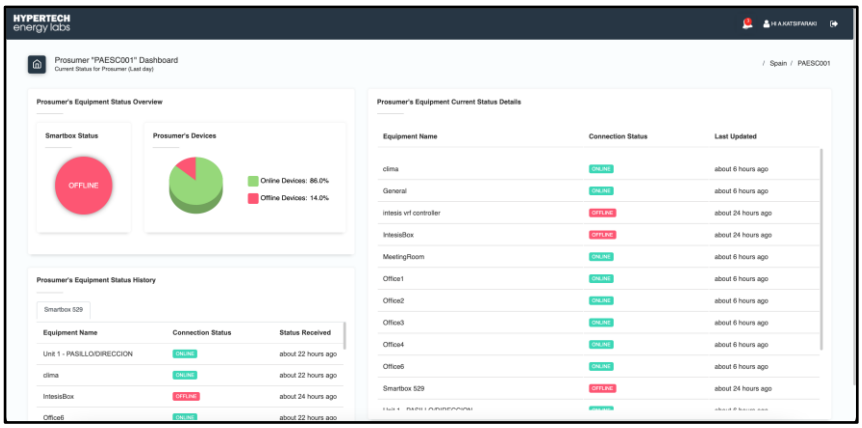


Figure 12: Monitoring tool

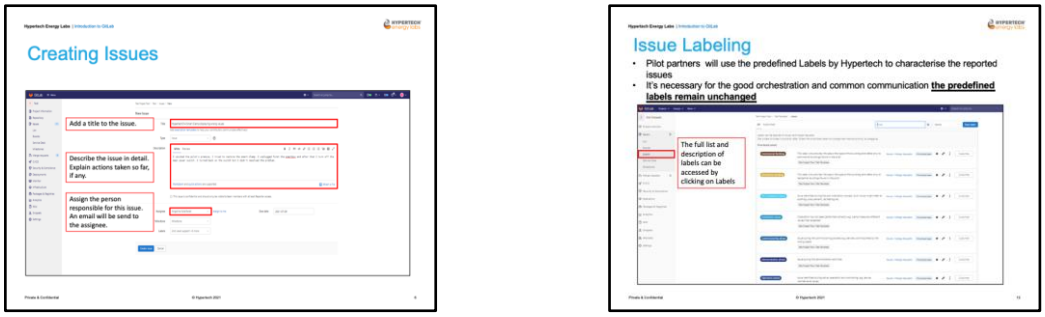


Figure 13: Slides from introduction to Gitlab

All material used for the two rounds of workshops was distributed to the participants to further support the pilot installation activities. This material included the presentation slides for both rounds, the commissioning manual and the commissioning demo video. Additionally, the credentials for accessing the services related to the installations (including the BLE application for easy network configuration and the installation health monitoring tool) were generated per commissioner to facilitate their task. Finally, a Gitlab group was created to established a direct communication channel enabling the issue reporting and tracking to facilitate the second level of support provided by Hypertech.

Deployment plans

In addition to the training activities organised and conducted for the technical orientation of the pilot partners, a deployment plan outlining the installation position, configuration and commissioning details of each IoT device was generated per prosumer for each pilot site. These plans aimed at further supporting the pilot partners on deploying the IoT system at the prosumers' premises, while also offering tips including the bring along equipment and cabling, and an estimation of the time each device generally requires to be installed. More specifically, each deployment plan consisted of four (4) sections:

(i) **Bring-along Equipment**: summarizing the devices to be installed based on the defined BoM along with: the installation required (DIY or hard installation performed by a certified electrician), the position to be installed, and the estimated installation duration. In addition, general recommendations on the additional equipment commonly required for the hard installations of the devices were included.

Local Hub / Bridge				
Device	**Quantity**	**Installer**	**Where to be installed**	**Installation**
Raspberry Pi - All components listed below will be put together following the instructions in Hypertech's manual and this devices will be treated as a single device				
Raspberry Pi 4 Model B 2GB	1	DIY	Anywhere close to the z-wave devices	Plug n' play
Official Raspberry Pi 4 Model B Black Case	1			
Raspberry Pi 4 Official Power Supply 5.1V 3.0A (White)	1			
Z-Wave Z-Wave. Me RaZberry 2 Module	1			
Samsung Pro Endurance microSDHC 32GB U1 with Adapter	2			
Consumption Monitoring/control				
Device	**Quantity**	**Installer**	**Where to be installed**	**Installation**
AEOTEC Home Energy meter Gen5	2	Certified Electrician	Circuit Board	20'
Ambient Sensing and Occupancy Sensing				
Device	**Quantity**	**Installer**	**Where to be installed**	**Installation**
AEOTEC Multisensor 6 - Each sensor with a power supply will be treated as one device				
Aeon Labs Multisensor 6 - Z-Wave Plus (Temperature - Humidity - Light Sensor - Presence)	8	DIY	In each zone defined	Plug 'n Play
5V USB Power Supply	8			
Additional Equipment				
Ethernet Cable for commissioning the gateway.				
Additional cables might be required for the installation of devices which are to be wired on the circuit board or with with other devices (e.g. thermostats). The exact type of wires required will				

Figure 14: Indicative bring along equipment

(ii) Deployment Plan: a detailed plan defining where each device was to be installed and the configuration parameters for their successful commissioning.

Installation Order	Device	Installation	Commissioning		
			Information	Load Registration	
1	**Raspberry Pi**	**Plug n' Play** **Where?:** At an area with good Wi-Fi connection at a close distance to where individual devices will be installed. **How?:** Set up the device following the installations of the manual provided by Hypertech	**Country:** Spain **Zone Type:** Commercial **Zone Names:** PAESC001Office1, PAESC001Office2,PAESC001Office3, PAESC001Office4, PAESC001Office5, PAESC001Corridor, PAESC001MeetingRoom		
2	**AEOTEC Home Energy Meter Gen5**	**A certified electrician is required** **Where?:** Circuit board **How?:** Connect each clamp of the device to a phase of the main power supply on the circuit breaker board. Installation details in Hypertech's manual	**Device Name:** *To be decided by the commissioner **Single Phase load?:** No	**Type of Load:** Total Energy Metering **Refers to the whole building:** Yes **New load:** Yes **Label:** *To be decided by the commissioner	
3	**AEOTEC MultiSensor 6**	**Plug n' Play** **Where?:** Office1 **How?:**Connect to power through the power supply and place it away from any heat sources, with the front area of the device facing the room.	**Device Name:** *To be decided by the commissioner	**Type of Load:** AMBIENTSENSING **Refers to the whole building:** No **Zones:** PAESC001Office1 **New load:** Yes **Label:** *To be decided by the commissioner	
4	**AEOTEC MultiSensor 6**	**Plug n' Play** **Where?:** Office2 **How?:**Connect to power through the power supply and place it away from any heat sources, with the front area of the device facing the room.	**Device Name:** *To be decided by the commissioner	**Type of Load:** AMBIENTSENSING **Refers to the whole building:** No **Zones:** PAESC001Office2 **New load:** Yes **Label:** *To be decided by the commissioner	

Figure 15: Indicative deployment plan

(iii) Manuals: a list of links to the official manufacturer manuals for all the devices planned to be installed.

(iv) Floor plan indicating the device positions *(only in cases when such a floorplan was made available)*

5.3 Spanish Demo Site

5.3.1.1 Granada demo

The Granada demo-site consist of the D-STATCOM, which has been designed and manufactured by CIRCE and installed in the CUERVA's network, both project partners. As people and entities involved in this pilot are part of the PARITY project consortium, training activities are not expected.

5.3.1.2 Zaragoza demo

CIRCE demo-site consists in an enterprise environment, composed by CIRCE offices and its laboratories. The offices are fully automated lighting and heating systems, but the installations also count with electric vehicles chargers and it is in the process of installing photovoltaic on the roof. As people involved in this pilot are part of the PARITY consortium, no training is expected.

5.3.2 Installation & Commissioning

Urbener has two pilot plants, the Acesa building and the Urbener offices. In the two pilot plants, the air-conditioning system is controlled in real time. For this purpose, suitable walkways have been installed to the different outdoor units. Sensors have also been installed to measure the conditions in each room. In this way, information on consumption is available in real time while taking into account the variables of temperature, humidity and solar radiation.

5.3.2.1 Granada demo

The D-STATCOM developed in T6.2 consists of a 50-kW power electronics converter assembled inside a metal cabinet, that provides high IP, electromagnetic and vandal protection. The equipment is handled through the two doors at the front of the enclosure, and the rear of the enclosure can be accessed by rotating the pivoting mounting plate on which it is assembled, as Figure 16 shows.

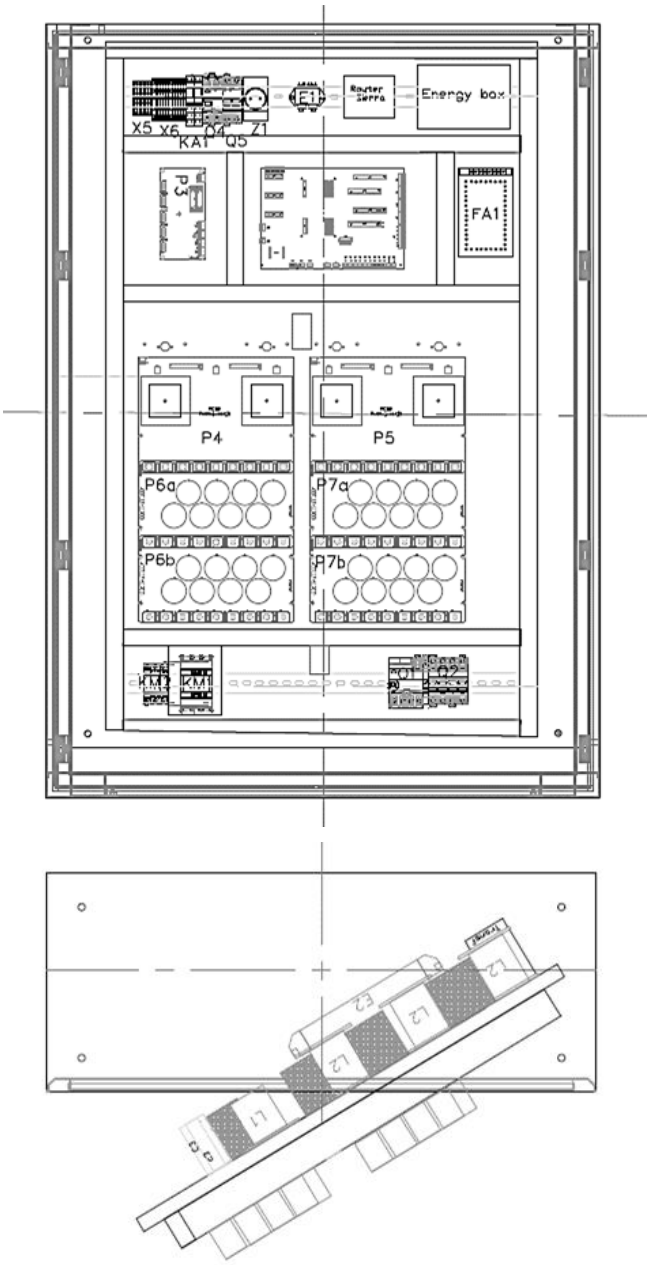


Figure 16: Front view inside the enclosure and top view of the mounting plate hinging

Figure 17 shows a dimensioned drawing of the installation of the equipment. The dimensions of the prototype are 1585 x 1500 x 1000 mm (h x w x d). The location of this equipment must allow the opening of the two doors of the cabinet. In addition, the enclosure shall have a clearance of approximately 24 cm at the front and both sides to allow air circulation for ventilation. So that, the total area required for the whole unit is approximately 1900 x 1200 x 1400 mm. The weight of the assembly is approximately 250 kg.

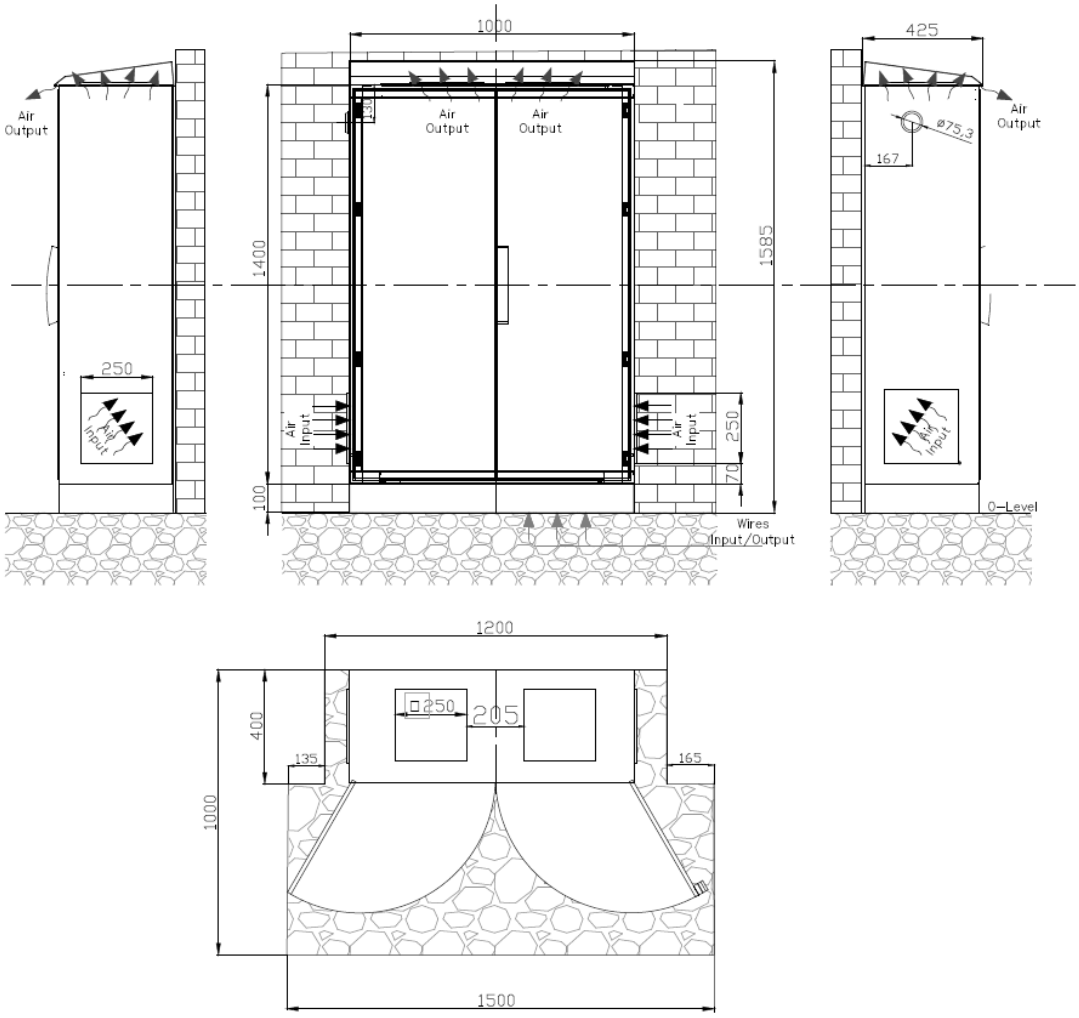


Figure 17: D-STATCOM dimensions and influence area.

The D-STATCOM is shunt connected to the low-voltage (400 V) power line through a connection box, as Figure 18 shows. The connection box shall consist of a cabinet annexed to the D-STATCOM, an underground pit or a connection box under the base of the cabinet, it must meet the conditions of watertightness and integrity of the components to be installed. The following protection and metering elements shall be installed in the connection box:

- **Protection**: The D-STATCOM shall be connected to the power line through a four-pole disconnector, of a rated current equal to or greater than 100 A, which allows the equipment to be disconnected from the mains for safe installation, de-installation and handling. The prototype has its own circuit breaker and four-pole differential. In addition, the DSO company may install all the protections it deems appropriate: fuses, PIA, differential, etc. The additional protections must also be four-pole, with a current of no less than 100 A, and the differential, if installed, must have the designation of "superimmunised".
- **Measurement**: To allow the D-STATCOM to operate autonomously, the current flowing through the three phases of the network must be measured. For this purpose, three current transformers, supplied together with the D-STATCOM, shall be installed in the network and downstream of the equipment, and their output shall be connected directly to the equipment.

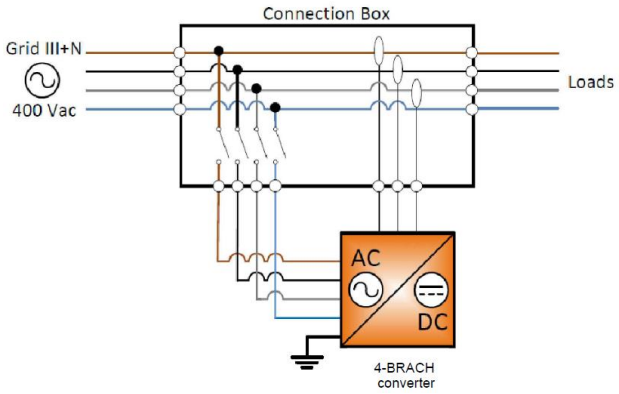


Figure 18: D-STATCOM connection box.

The connection of the D-STATCOM and sensors to the grid shall be made at the bottom of the equipment for water tightness and safety reasons. The equipment must be connected to a general earth connection, or an earth must be provided by means of stakes, for the protection of both the equipment and people.

The cross-section of the power wires to be used shall be 25 mm² for the phases and neutral, and 25 mm² for the earth cable. The wiring used throughout the installation must be halogen-free, suitable for outdoor use, free of intermediate splices. Likewise, all phases must be of the same length, avoiding loops. For the wiring of the current sensors, 2-wire hoses with a cross-section of 1 mm² shall be used.

5.3.2.2 Zaragoza demo

The installation of the devices in Urbener´s pilot plant was done by EIMER.

The commissioning of the service was done following the manual provided by Hypertech.

The first step is downloading the latest version of the IoT gateway firmware. Once the firmware image is downloaded it must be written in the gateway microSD card, by using the Etcher application. After that, the microSD is put into the Raspberry Pi.

For starting the commissioning process, IP Scanner software will allow the commissioner to find the local IP address of the installed gateway.

For the first boot of the IoT gateway, the following steps are followed:

1. Connect the gateway to the internet using an Ethernet cable
2. Insert the SD card to the IoT gateway
3. Start up the IoT gateway using power supply and wait at least 2 minutes

In order to commission the devices in the app the steps are:

1. Building all the necessary information concerning the zones that the gateway will be attached to should be inserted. The following image is of the commissioning app.

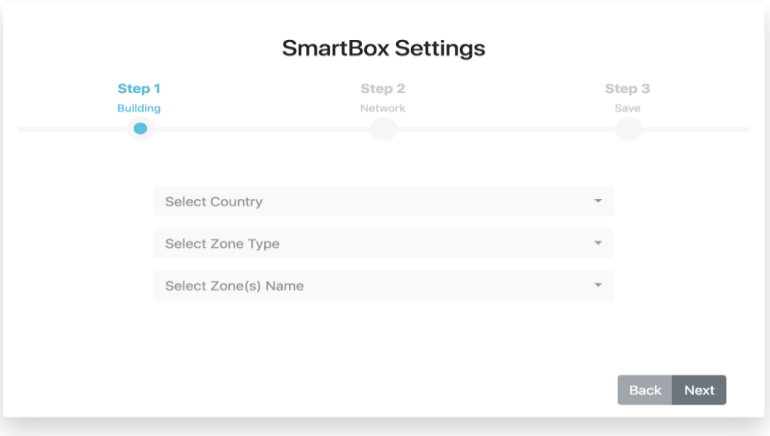


Figure 19: Commissioning App caption

Once the above inputs are configured, a complete list with the available zone IDs, as defined during the audits, will be available in the third dropdown menu "**Select Zone(s) Name**". There the commissioner should select ***one or more***, zone IDs

2. The second step refers to the Wi-Fi configuration of the IoT Gateway. The user should select the correct Wi-Fi network and insert the password in order for the IoT Gateway to access the WLAN network.

Once both the building information and Network Configuration are given correctly to the IoT Gateway, the commissioner should click "Save" in order for the IoT Gateway to be safely stored in the cloud. Of course, no personal information such as Wi-Fi credentials will be saved.

Once the procedure completed successfully, the application will be redirected to the "Device Commissioning" view.

Device commissioning

The "Device Type" container, where all the compatible device types presented. Specifically, the PARITY solution is compatible with four different device types.

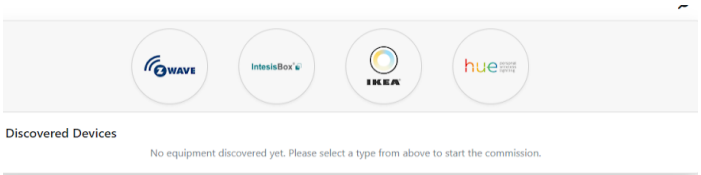


Figure 20: Compatible Device Types

a) **Z-Wave Devices**, including every Z-Wave or Z-Wave Plus devices (most of the under commissioning IoT devices belong to this category)
b) **Phillips Hue Devices**, including all the devices that are compatible with the Phillips Hue gateway.
c) **IKEA Tradfri Devices**, including all smart-lighting products provided by IKEA.
d) **IntesisBox devices**, including all the WiFi enabled HVAC remote controllers provided by Intesis.

For Urbener, only Z-wave devices and IntesisBox device are going to be used. The devices were configured in accordance with the deployment plan for Urbener´s office deployment plan and in Acesa according to Acesa´s deployment plan.

5.4 Greek Demo Site

5.4.1 Installation & Commissioning

During this stage, the commissioner is the responsible for the implementation and the commission of the system and the procedures in the pilot sites. Additionally, technicians are assigned to fulfil supplementary installations on-site. End-users are also important key players and contributors, given that many of the solutions are Plug and Play and require the active involvement of the end-users.

For each one of the demo cases, a detailed deployment plan has been prepared with (i) the equipment to bring along before the installation and, (ii) the steps to follow during the installation for the successful installation of PARITY solution. The overall structure of the plan is depicted in Figure 21. As it can be seen, the plan is divided into 5 categories, based on the category that each device belongs to (i.e., local hub, consumption monitoring, HVAC system status monitoring and control, ambient and occupancy sensing and additional equipment). For each one of the demonstration sites a special deployment plan has been set up, thus BFS will in advance calculate the requirements and planned duration of the installation in order to plan meetings for each pilot site.

Before the on-site visit – Bring-along equipment

Device	Quantity	Installer	Where to install	Installation Duration
Local Hub / Bridge				
Raspberry Pi – All components listed below will be put together following the instructions in Hypertech's manual and this devices will be treated as a single device.				
Raspberry Pi 4 Model B 2GB	1	DIY	Anywhere close to the z-wave devices	Plug n' play
Consumption Monitoring / Control				
Shelly EM + 2X50A Clamp will be attached on the Shelly 2.5 / EM DIN bracket and they will be treated as one device				
Shelly EM + 2x50a Clamp, Shelly 2.5 / EM DIN bracket	1	Certified Electrician	Circuit Board	20'
HVAC System – Status Monitoring / Control				
Universal IR Air Conditioner to Home Automation Interface	1	DIY	On the wall next to the AC unit	Plug n' play
Ambient Sensing and Occupancy Sensing				
Aeon Labs Multisensor…	1	DIY	In the zones indicated in the deployment plan	Plug n' play
Additional Equipment				
Ethernet Cable				

During the installation – Deployment Plan

The commissioning process must be conducted in the exact order presented below!

Installation Order	Device	Installation	Commissioning		
			Information	Load Registration	
1	Raspberry Pi	**Plug n' Play** **Where?** At an area with good Wi-fi connection at a close distance to where individual devices will be installed **How?** Set up the device following the instructions of the manual provided by Hypertech	**Country**: Greece **Zone Type**: Residential **Zone Names**: PARGRR0043Bedroom		
2	Shelly EM	**A certified electrician is required** **Where?** Circuit Board **How?** Connect the first clamp of the device to the main power supply … **Note:** Attach the device pm the DIN rail …	**Device Name:** *To be decided by the commissioner	**Type of load**: Total Energy Metering **Refers to the whole building**: Yes **Label**: *To be decided by the commissioner	Type of load: DHW **Refers to the whole building**: Yes **Label**: *To be decided by the commissioner
3	ICT 40A 2NO 240VAC 50Hz MO contact	**A certified electrician is required** **Where?** Circuit Board **How?** Replace the existing circuit relay of the electric water heater	**No commissioning required**		

Manuals:

- AEOTEC Home Energy Meter Gen 5: https://aeotec.freshdesk.com/support/solutions/articles/6000161943-home-energy-meter-gen5-user-guide-
- Shelly EM + 50A Clamp: https://shelly.cloud/documents/user_guide/shelly_em.pdf
- Qubino Smart Plug 16A: https://qubino.com/wp-content/uploads/2019/03/Qubino_Smart-Plug-16A-PLUS-extended-manual_eng_2.5.pdf
- AEOTEC Multisensor 6: https://aeotec.freshdesk.com/support/solutions/articles/6000057073-multisensor-6-user-guide-
- INTESIS Manual: https://www.intesis.com/docs/user-manual-inwmpxxx001xx00

Figure 21: Example of the deployment plan for the Greek demo site

5.5 Swiss Demo Site

5.5.1 Installation & Commissioning

AEM installed and commissioned all the necessary equipment for users AEM006, AEM014, and for the commercial user (Municipality), as part of the early deployment for pre-validation activities (T8.4).

For residential users AEM006 and AEM014 the following equipment was commissioned:

- 1x gateway to allow communication to the cloud
- 1x range extender to extend the Z-Wave signal for a more robust connectivity (not fixed)
- 1x energy meter connected to the electric boiler

For the commercial user the following equipment was commissioned:

- 1x gateway to allow communication to the cloud
- 1x range extender to extend the Z-Wave signal for a more robust connectivity (fixed)
- 2x energy meter connected to the 2 external AC units
- 6x temperature/occupancy/humidity sensors in each room with AC
- 6x Intesis device for remote AC monitoring and control

As mentioned in the previous chapter, the commissioning of the devices in the premises of AEM008 and AEM017 is delayed due to the late delivery of the Raspberry PI (gateway) by the supplier. Commissioning is expected by mid of M30.

Remaining users AEM002, AEM007, AEM009, AEM012, AEM013, AEM018 exploit the already installed HIVE infrastructure presented in the previous chapter. This allows a direct communication with users' heat pumps and/or electric boilers through the household smart meter.

For the residential user AEM005, the user's heat pump will be connected directly to the Internet using the basic cloud connectivity functions provided by the manufacturer (free of charge). However, as mentioned in the previous chapter, this requires an external Internet connection, which will be configured by the end of M30.

5.6 Swedish Demo Site

5.6.1 Installation & Commissioning

Bellow follows a description of the installation and commissioning activities required for the Swedish pilot.

The Swedish pilot site is made up of two geographically separated locations, a multifamily apartment building in Malmö, Sweden (residential site) and an office building in Karlshamn, Sweden (commercial site).

Due to the geographical separation of the two sites, the installation and commissioning of the stationary storage could not take place simultaneously, but rather sequentially. The list below provides a description of the installation and commissioning activities.

- Survey pilot site for optimal battery energy storage system placement
- Order fire report from third-party consulting company and confirm suggested placement of system based on the result of the report and fire regulations in Sweden, as well as communication with pilot site responsible parties such as housing association board or property owners
- Order and activate insurance of system based on recommendations from fire safety report
- Plan delivery of large hardware components
- Manually position hardware components and place batteries into racks
- Design electrical installation together with specialist electrical installers based on already existing electrical structure of site
- Order materials (fuse boxes, specialty cabling, etc.), EMS device and supporting metering equipment
- Electrical installation of hardware components and metering equipment carried out by specialist electrical installation service provider
- Set up network connection of battery system (BMS, EMS, etc.)
- Commissioning of hardware components is required to be carried out by specialist technicians from battery and power converter companies. Since these are not local to the pilot site locations, this is to be booked in advance and full access site visit is to be organized
- Electrical commissioning of entire system by specialist electrical installers confirming the operation of battery system. Setup and formalize post installation service and operation agreement during the pilot phase

The EMS consists of the PV Manager and the Stationary Battery Manager. It has already been installed at the pilot sites and pre-runs have been performed. Problems have been encountered with the batteries that needs fixing (explained in section 6.4). The EMS has been developed and tested on non-PARITY sites. System checks and verifications will be performed as soon as the battery supplier has fixed the battery issues.

6. LESSONS LEARNT FROM THE DEPLOYMENT OF THE PARITY EQUIPMENT

6.1 Lessons learnt at the Spanish demo-site

The installation and commissioning of the automated heating and lighting control system in CIRCE facilities has been a challenging task, in terms of time consumption and workforce needed. Due to the COVID-19 situation, the commissioning suffered a relevant delay regarding the equipment installation. Modifying the comfort variables of an entire office with over 200 employees has been very time-consuming activity, in order to meet the requirements of the majority of the people involved. It has been a better approach to maintain a correct lighting and heating levels all over the office, considering the recommendations of the health authorities.

For future deployments, a larger period for installation and commissioning should be scheduled, and a general comfort configuration should be prepared, instead of adapting to each person, at least in large facilities.

Besides, the D-STATCOM device developed by CIRCE face a challenge regarding the installation. The device installation depends not only on technical aspects of functionality, but also on restrictions due to physical space and local government's approval. This is due to the fact that the system is located in urban areas, needing civil works and adaptation for every proposed site.

6.2 Lessons learnt at the Greek demo-site

It is foreseen that a challenging activity will be the training of some end-users in the residential pilots in order to perform the Plug-and-Play installation, as it is highly dependent on the expertise and interest of each one. Considering a total 8.5% of people over 54 years old (refer to D8.2 "Report on activities for engaging and training pilot participants and related material" [2] for more information), it is expected that special attention will be given to familiarize them with the technologies and the installation procedure. Similar to the constant engagement of the end-users during the on-site audits, engagement actions will also take place during the installation process with the objective to perform a successful deployment.

Additionally, due to the activities of the residential demo occupants we can confront delays in arranging an appointment for the equipment's installation. Taking into account that almost half of the Greek pilot site participants are employed full time (D8.2), the appointments planning can be challenging. A careful coordination between the availability of the technicians and the occupants will be implemented.

Overall, more information regarding the lessons-learnt will be provided in the updated version of the present deliverable, when the deployment is fully completed.

6.3 Lessons learnt at the Swiss demo-site

The major setback at the Swiss pilot site is related to the procurement of the necessary equipment, in particular of the Raspberry PI, due to the global shortage in semiconductors. However, this represents an unpredictable issue due to the pandemic affecting many industries.

Another point worth mentioning is related to the connectivity of the gateway, which requires a robust signal. Most of the time, heat pumps and boilers are installed in the basement where user's Wi-Fi signal strength is weak, affecting the connectivity of the whole system. A careful analysis of internet Wi-Fi signal in the relevant areas of the house would be desired. As an alternative, independent external internet

connectivity solutions could be evaluated, for example the HIVE Raspberry already installed use a 4G mobile connection

As a last point, users may be sceptical about having additional IoT devices in their household, especially if new wireless signals are present (e.g. Z-Wave). This can be prevented by communicating effectively and transparently with the users and addressing their concerns proactively.

6.4 Lessons learnt at the Swedish demo-site

The main lessons learnt during the commissioning activities at the Swedish demo-site are the following:

- Fire safety documentation and surveying is vital for battery installations in Sweden. Cooperation with the local fire department is mandatory for insurance companies.
- The electrical installation undertaking on the DC side was much more specialized and time-consuming than initially expected. In the future, it is important to set aside sufficient time and money for such an installation.
- Sourcing of DC fuses was very time-consuming, and supply was limited in the required size range. Fuses were eventually purchased from Germany.
- NiMH battery modules release a large amount of heat when operational at full capacity. In future, it is recommended to allocate a larger space for the installation than the suggested numbers in the installation manual.
- Network challenges arose at the residential site. Multifamily apartment buildings have a third party that manage the network thus adding a few administrative steps when setting up the required internet connection. Consider resolving this before the electrical installation begins, for future.
- During the commissioning of the battery systems, significant problems were encountered with the operation of the Nilar NiMH battery cells. These problems should have been addressed by the battery manufacturer during the production phase of the battery systems. The commercialization of the battery solution developed as part of the PARITY project will therefore not include these batteries. In future, extra investigation into the financial health of hardware suppliers will be mandatory.

7. CONCLUSIONS

This document provided a report on preparation and hardware equipment installations at the pilot sites of PARITY. In particular, with regard to preparations, the deployment time plan has been presented for each demonstration site by using Gantt diagrams, and pilot-specific procurement specifications have been provided. Then, the installations and commissioning activities, including the training activities, have been described. The installation of different types of equipment has been described, such as the D-STATCOM device installed at the Granada demo site. Additionally, the key roles of involved personnel within the pilot deployments have been presented along with their main responsibilities.

For the duration of the task, a number of challenges have been faced such as the global pandemic and the shortage in semiconductors that introduced some delays in the time plan but overall, it has been possible to carry out the planned actions in a reasonable timeframe. The main lessons learnt that were reported by the pilot partners are the following: (a) Careful time planning to cope with difficulties, when dealing with a large number of people in offices; (b) During the procurement process, pay attention to the availability of materials and possible shortages; (c) During the procurement process, perform additional investigation when choosing certain materials or equipment, such as stationary batteries; (d) Ensure better communication with the end-users in order to perform the training and familiarize with new equipment.

The hardware equipment installations that have been carried out and described in this document will be followed by the deployment of PARITY software components, allowing to perform certain pre-validation activities as well as the final evaluation of the system.

8. REFERENCES

[1]. PARITY deliverable, D7.1 - PARITY IoT platform & Oracle, Dissemination level: Confidential, March 2021.
[2]. PARITY deliverable, D8.2 - Report on activities for engaging and training pilot participants and related material, Dissemination level: Public, December 2021.

ANNEX I: Manuals

Project Acronym:	**PARITY**
Project Full Title:	**Pro-sumer AwaRe, Transactive Markets for Valorization of Distributed flexibilITY enabled by Smart Energy Contracts**
Grant Agreement:	**846319**
Project Duration:	**42 months (01/10/2019 – 31/03/2023)**

PARITY IoT Gateway Configuration & Device Commissioning Manual

Work Package:	**WP8 – System integration, demonstration and impact assessment**
Task:	**T8.3 – Procurement of hardware infrastructure and deployment/integration in pilot sites**
Document Status:	**Draft v1.1**
File Name:	**PARITY_Commissioning Manual_v1.0**
Due Date:	**N/A**
Creation Date:	**22/09/2021**
Lead Beneficiary:	**Hypertech**

Dissemination Level	
Public	
Confidential, only for members of the Consortium (including the Commission Services)	X

Authors List

Leading Author				
First Name		Last Name	Beneficiary	Contact e-mail
Kostas		Kompos	Hypertech	k.kompos@hypertech.gr
Co-Author(s)				
#	First Name	Last Name	Beneficiary	Contact e-mail
1	Ismini	Dimitriadou	Hypertech	i.dimitriadou@hypertech.gr

Version History

Version	Author	Date	Status
0.1	K.Kompos, Hypertech	December, 2020	First version
1.0	K.Kompos, Hypertech	September, 2021	Final version
1.1	K.Kompos, Hypertech	October, 2021	Addendum – new final version

Legal Disclaimer

The PARITY project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 864319. The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the Innovation and Networks Executive Agency (INEA) or the European Commission (EC). INEA or the EC are not responsible for any use that may be made of the information contained therein.

Copyright

Table of Contents

List of Figures

List of Tables

No table of figures entries found.

1. PARITY IoT Gateway Configuration

In this section, a complete guide for the proper configuration of the PARITY IoT Gateway is presented. Starting from the assembly of all the different components that come together with the PARITY IoT Gateway, the Gateway firmware installation and the commissioning of the device into the PARITY cloud infrastructure are described, by coupling it with one or more pilot zones as they were defined during the audits.

1.1 Firmware Installation

1.1.1 Firmware Download

Download the latest version of the IoT Gateway firmware using the following link.
https://drive.google.com/file/d/1-ifPLf7GCK_F5pY5B56VVgrhvip_91g9/view?usp=sharing

Note, the link does not allow to download the firmware because this document is public, therefore the firmware has been removed. The manual is in the annex as proof of its existence.

Once the firmware image is downloaded, follow the instructions bellow in order to install it to the gateway's microSD card.

1.1.2 Write the image file on the microSD card[2]

You will need to use an image-writing tool to install the image you have downloaded in your SD card.

1. Download Etcher and install it.
2. Connect an SD card reader to your computer with the SD card inside.[3]
3. Open Etcher and select from your hard drive the image file (.img) downloaded in 1.1.1 Firmware Download
4. Select the SD card you wish to write your image to.

Review your selections and click 'Flash!' to begin writing data to the SD card.

1.2 PARITY IoT Gateway

The IoT Gateway is comprised of 5 different components:

1. The Raspberry PI 4 Model B
2. The Z Wave Antenna (RaZberry)
3. The microSD card
4. The Raspberry PI Case
5. The Power Supply

The core of the device is the Raspberry PI card; therefore, it is crucial that all the peripherals are connected according to this manual to ensure its smooth operation. The following images show how the gateway components should be assembled.

[2] The official image loading instructions provided by Raspberry Pi can be found here.

[3] All microSD cards come with an adaptor in order to be compatible with any SD Card Reader.

Figure 1. PARITY IoT Gateway Components overview

Figure 2. Attach the Raspberry PI Card on the case back-plate

Figure 3. Connect the Z Wave Antenna to the Raspberry PI Pin Header

Figure 4. Attach the case top plate to the assembly

Figure 5. Connect the casing side plates

Figure 6. Connect the casing side plates

Figure 7. Attach the casing top cover

Figure 8. Insert the microSD card to the relative slot

IMPORTANT NOTICE

The gateway should not be powered on prior to the installation in its respective zone(s). During its first boot, the device should be connected to the Internet using an Ethernet Cable.

1.3 PARITY IoT Gateway configuration - commissioning

In this chapter, all the necessary steps for the appropriate configuration and commissioning of the PARITY IoT Gateway to the PARITY's cloud infrastructure are presented and explained. Please install all the necessary third-party software in order for the configuration and commissioning process to run smoothly.

1.3.1 Required third-party software

1.3.1.1 Google Chrome Browser

Please follow the link[4] in order to download and install the latest version of google chrome. Detailed instructions on how to install this software can be found inside the website.

1.3.1.2 IoT Gateway IP Detection Software

The following software will allow the commissioner to find the local IP address of the installed gateway.

Please follow the link[5] in order to download Angry IP Scanner. Please choose the appropriate version according to your operating system; there are available versions for Windows, Linux and Mac OS PCs. As soon as you install the downloaded file and run Angry IP scanner, the following screen will appear.

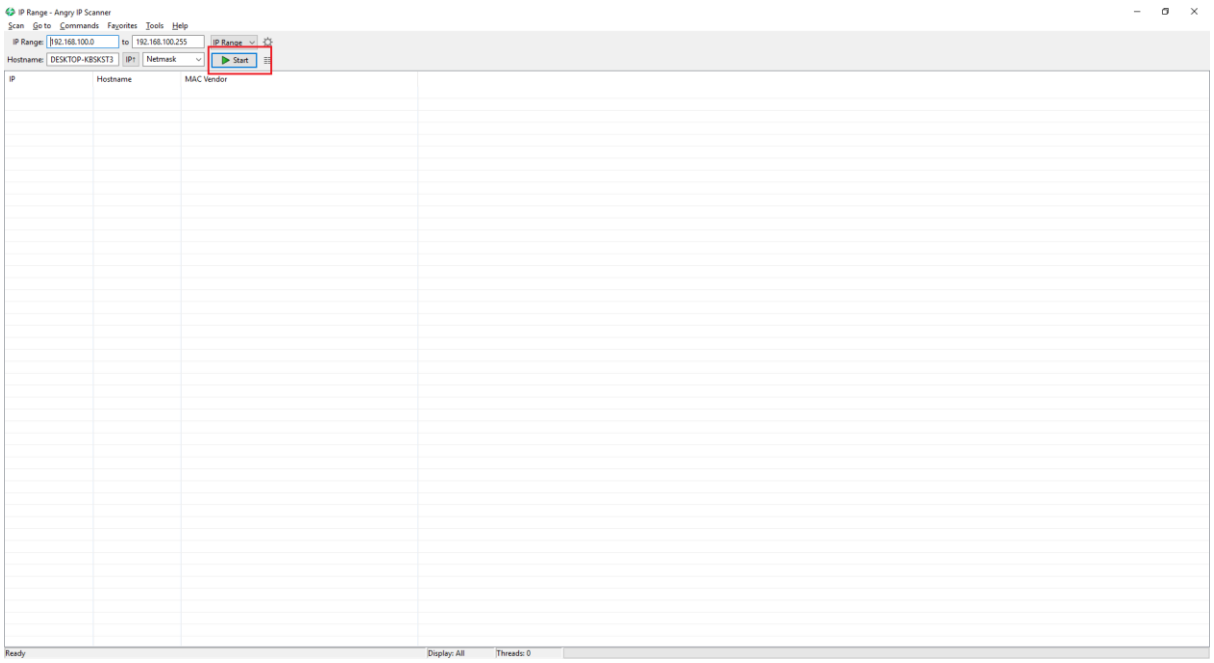


Figure 9. Angry IP Scanner screen

Press the "Fetchers" Button ( ) and select the following add "MAC Vendor" to the selected fetchers list.

[4] If the link does not work, please navigate to the following page (https://www.google.com/chrome/).

[5] If the link does not work, please navigate to the following page (https://angryip.org/download).

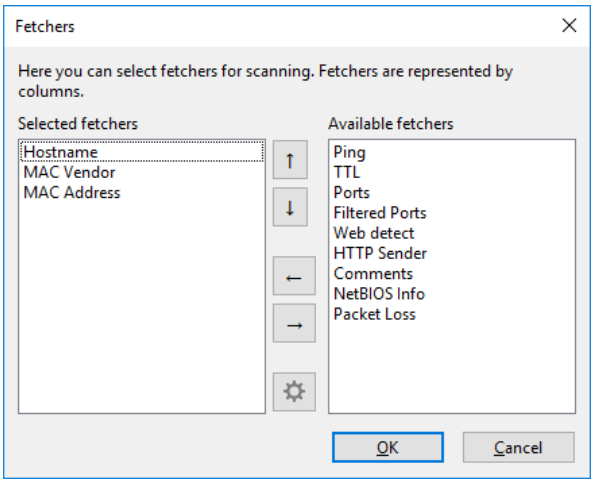


Figure 10. Angry IP Fetchers

Please press the **"Start"** button and wait for the scanning process to be completed. A pop-up window will be shown informing you that the process is finished and a number of connected devices are scanned.

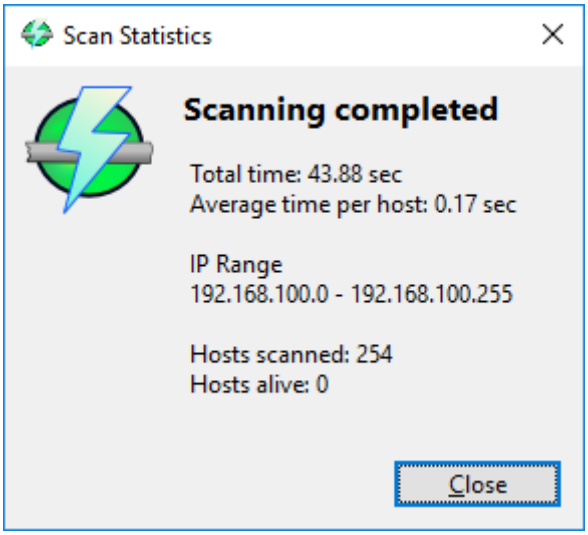


Figure 11. Scan results screen

In the generated list search for the **"smartbox.local"** Hostname and copy the IP address next to it.

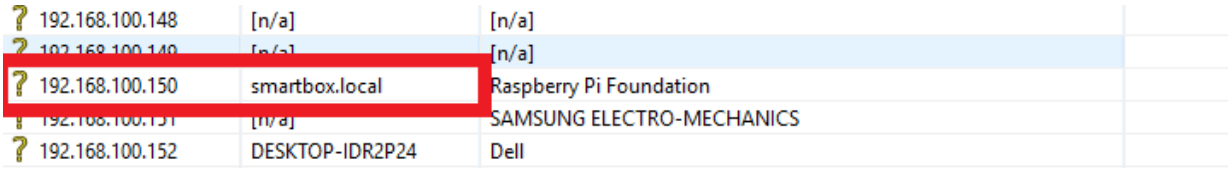


Figure 12. List of hostnames and IP addresses

The IP address of smartbox.local must be copied

1.3.2 PARITY IoT Gateway Configuration and Commissioning

1.3.2.1 IoT Gateway First Boot Instructions

Please follow these steps in order to boot the IoT Gateway for its very first time.

1. Connect the gateway to the internet using an Ethernet cable.

The cable connects the Raspberry Pi Ethernet Port to an active Ethernet Wall plug[6] or directly to the router.

2. Insert the SD card to the IoT Gateway. (See Figure 8)

The SD card should have the gateway firmware already installed.

3. Start up the IoT Gateway using its power supply and wait at least 2 minutes.

Important Notice

The steps described in this section are highly strict. Any deviation will possibly affect the communication between the gateway and the cloud.

1.3.2.2 Open Commissioning App

In order to access the commissioning app, please make sure that the computer that you are using for the commissioning process is connected to the same network as the IoT Gateway, and that all the third-party software is also already installed. (See: 1.3.1 Required third-party software).

1. Open chrome application and navigate to:

http://<IP-address>

For the current example the link should be: http://192.168.100.150 (See: 1.3.1.2 IoT Gateway IP Detection Software).

2. After some seconds[7], the commissioning application will open.

1.3.2.3 Insert Zone Information for Residential buildings

In Step 1 – Building (Figure 13) all the necessary information concerning the zones that the gateway will be attached to should be inserted.

- In the first input "**Select Country**", the commissioner has to select the country where the zone/s on which he is currently working are located.
- In the second input "**Select Zone Type**", please select Residential from the drop-down menu.
- Once the above inputs are configured, a complete list with the available zone IDs, as defined during the audits, will be available in the third dropdown menu "**Select Zone(s) Name**". There the commissioner should select ***one or more***, zone IDs (Figure 14).

[6] The Ethernet plug should provide internet connectivity to the connected device

[7] Depends on the internet connection speed

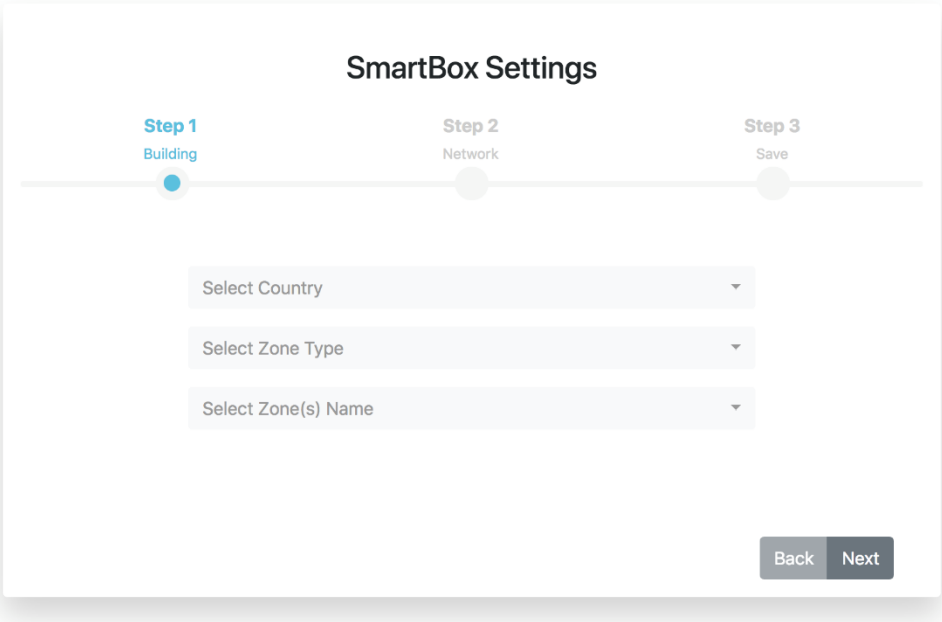


Figure 13. Commissioning App caption

(IoT Gateway is neither commissioned nor configured)

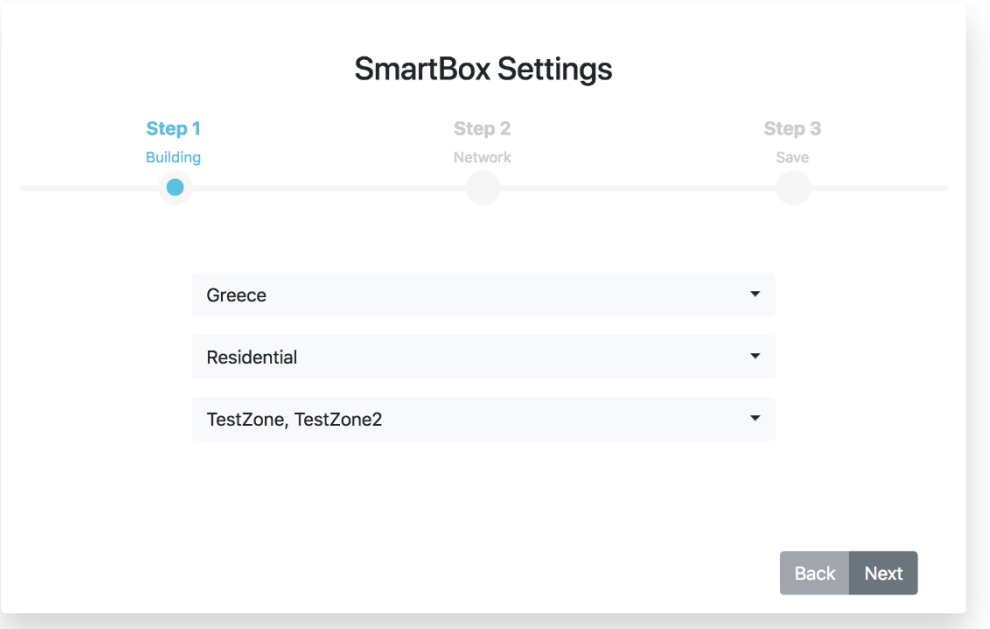


Figure 14. Zone Information passed and validated

1.3.2.4 Insert Zone Information for Commercial buildings

In Step 1 – Building (Figure 15), all the necessary information concerning the zones that the IoT Gateway will be attached to should be inserted.

- In the first input "**Select Country**", the commissioner has to select the country where the zone/s on which he is currently working are located.
- In the second input "**Select Zone Type**", select Commercial from the drop-down menu. In this case, the user is required to also insert a Hostname for the specific IoT Gateway. It is strongly recommended that the user-defined Hostname is meaningful and easy to recognize. Upper cases and symbols (e.g. @, $, *, -, # etc.) are not allowed.
- Once the above inputs are configured, a complete list with the available zone IDs, as defined during the audits, will be available in the third dropdown menu "**Select Zone(s) Name**". There the commissioner should select ***one or more***, zone IDs.

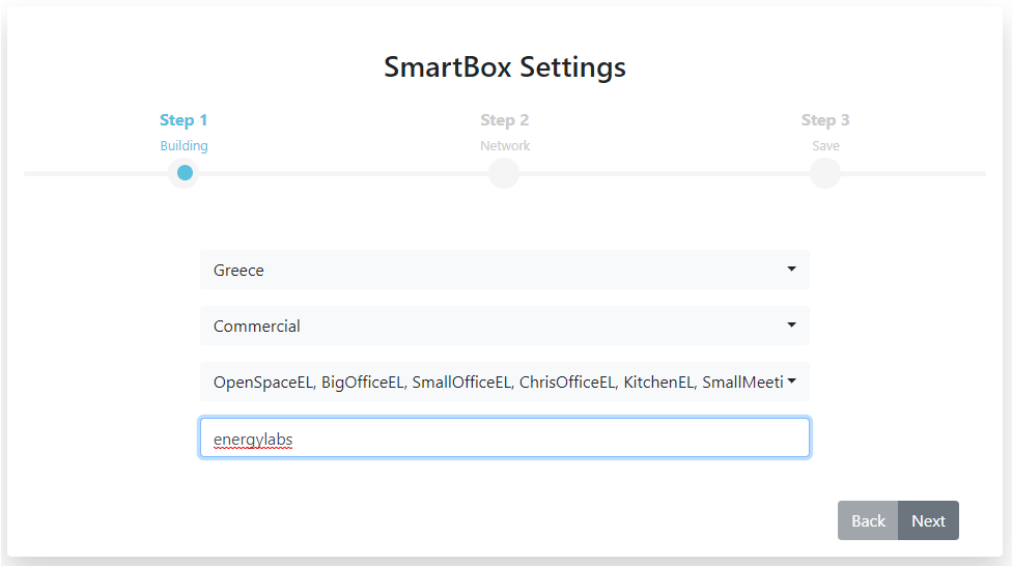


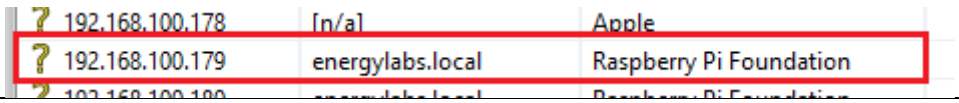
Figure 15. IoT Gateway Hostname provided for commercial zones

- Once the above inputs are configured, a complete list with the available zone IDs, as defined during the audits, will be available in the third dropdown menu "**Select Zone(s) Name**". There the commissioner should select ***one or more***, zone IDs.
- Once all the above information is passed and validated, click "Next" to continue with the Network Configuration.

Important Notice

For Commercial zones, after the first commissioning of the PARITY IoT Gateway, the user-defined Hostname replaces smartbox.local. If later on the user wants to commission new devices, the IP address of the corresponding IoT Gateway can be found under Hostname.local.

For example, in Figure 15 the given Hostname during the IoT Gateway first commissioning is *energylabs*. According to this, the IoT Gateway IP found following the steps described in 1.3.1.2 is:



1.3.2.5 Validation mechanisms

As this information is crucial for the commissioning of the whole PARITY solution to the cloud, several different validation mechanisms are running in parallel in order to ensure that all the necessary information is filled out by the commissioner.

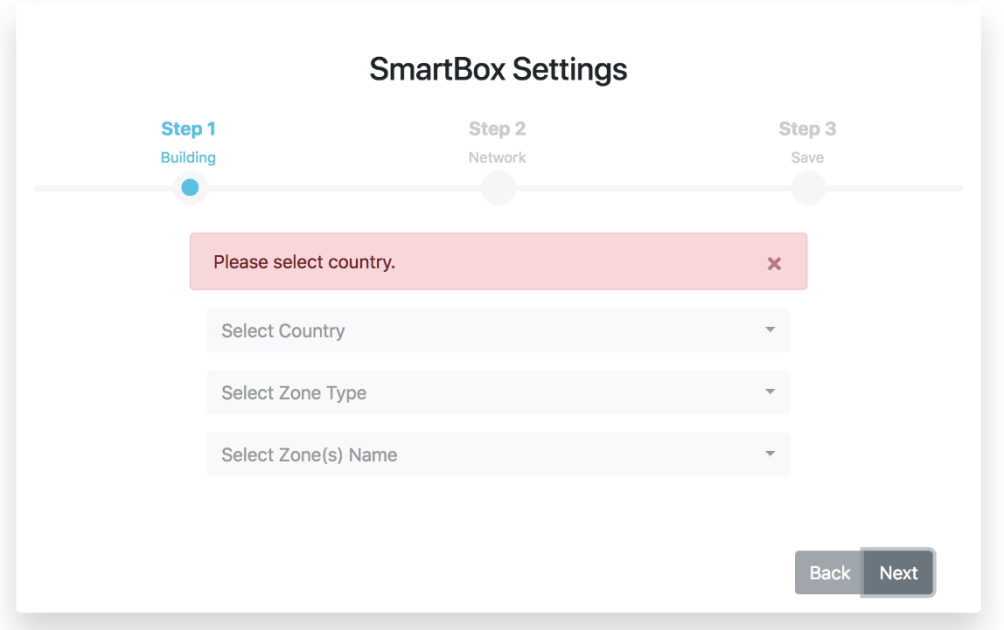


Figure 16. Error message produced by validator

1.3.2.6 Network Configuration

The second step refers to the WiFi configuration of the IoT Gateway.

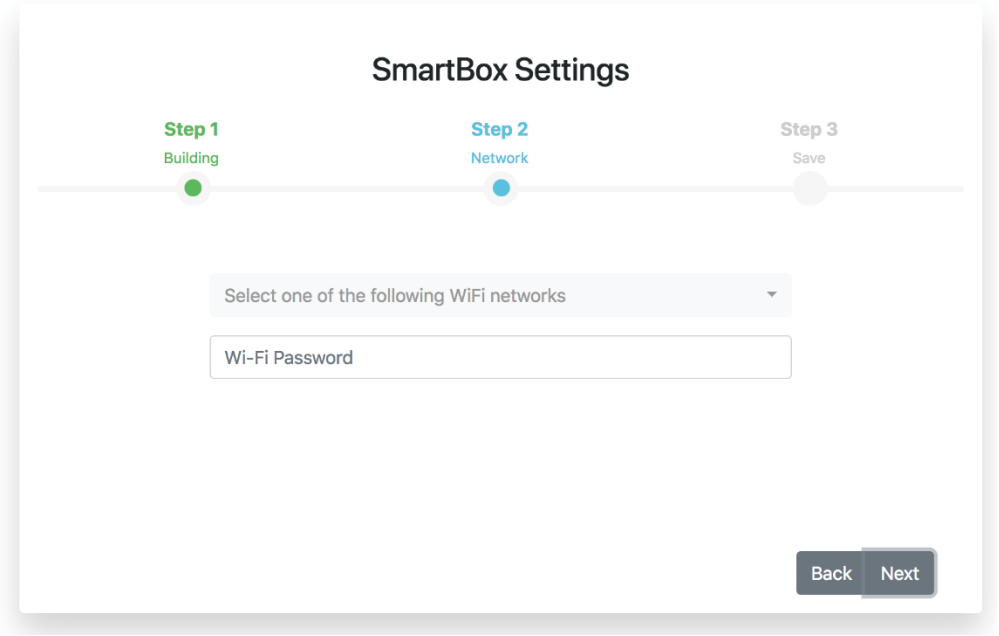


Figure 17. Network Configuration Step

Here, the user should select the correct Wi-Fi network and insert the password in order for the IoT Gateway to access the WLAN network.

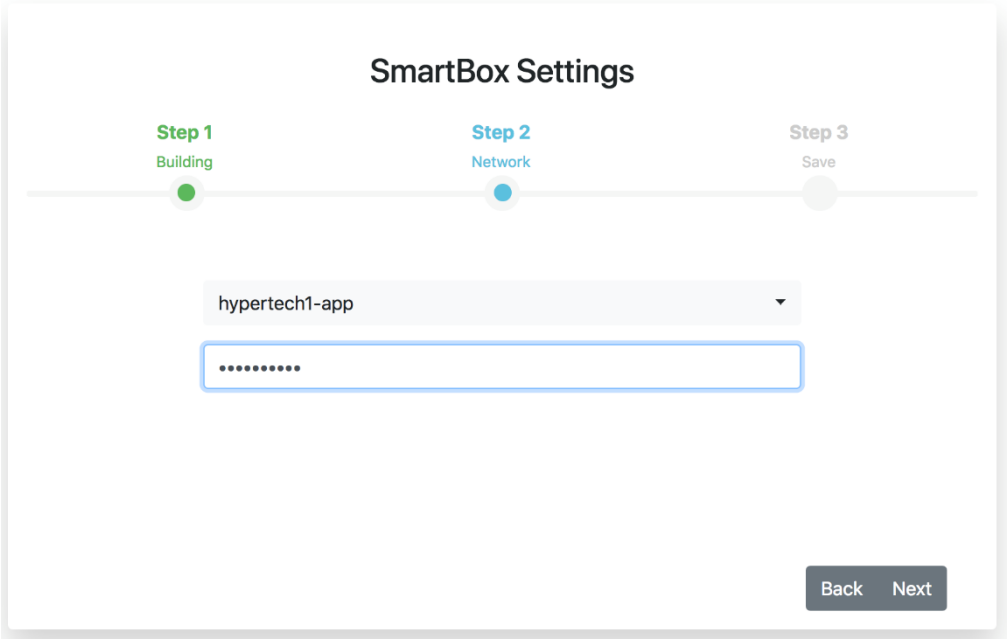


Figure 18. WLAN data passed to the application

By clicking "Next", the network information is validated and if it is correct, the IoT Gateway can access the zone's wireless network.

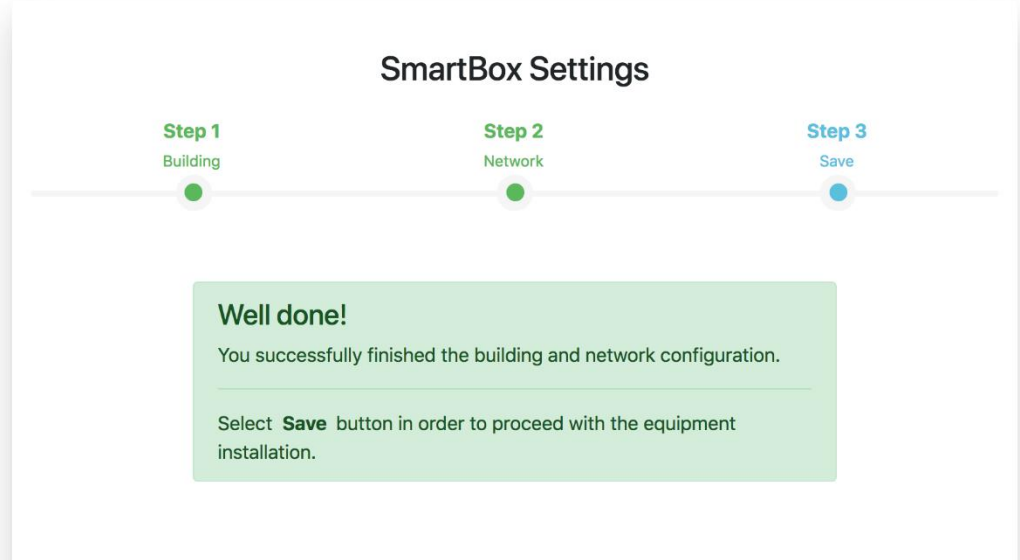


Figure 19. Wi-Fi credentials are correctly passed

(The IoT Gateway is now connected to the Wi-Fi)

If the Wi-Fi credential are not correct, or there is any other connectivity issue, the application will show the following error message.

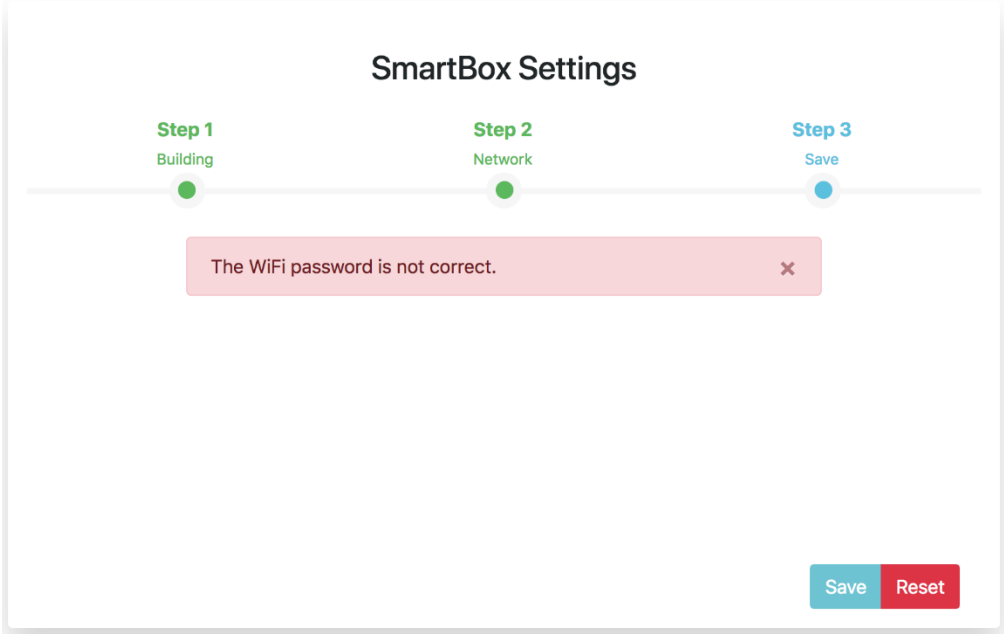


Figure 20. Incorrect credentials given

In this case, the user should press button “Reset”, to navigate again to the “Step 2” and again press the “Next” button to re-insert Wireless Network credentials.

1.3.2.7 Save IoT Gateway configuration to Cloud

Once both the Building information and Network Configuration are given correctly to the IoT Gateway, the commissioner should click “Save” in order for the IoT Gateway to be safely stored in the cloud. Of course, no personal information such as Wi-Fi credentials will be saved.

Once the procedure completed successfully, the application will be redirected to the “Device Commissioning” view.

1.3.3 IoT Gateway shutdown

The IoT Gateway is an embedded computer system. This means that improper shutdowns may cause severe problems either to the software or to its hardware. So, if for any reason the gateway should be shut down, please click the link below to shutdown properly the device.

http://<ip-address>/smartbox/shutdownNow

After 1 minute at least power cable can be removed from the device.

1.3.4 Network Re-configuration

For performing network re-configuration please use the following link in a chrome browser.

http://< ip-address >/network

Here, the user should select the country and then the correct Wi-Fi network. Afterwards, the user should insert the password in order for the IoT Gateway to access the new WLAN network.

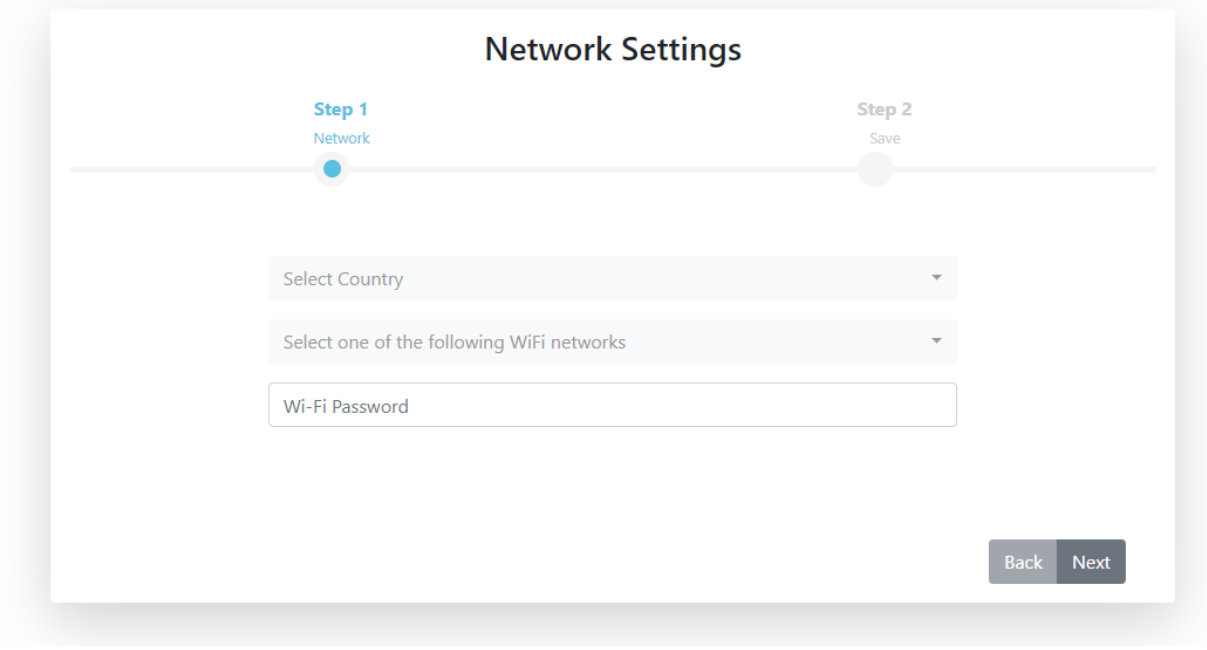


Figure 21. Network Re-configuration page

2. Device Commissioning

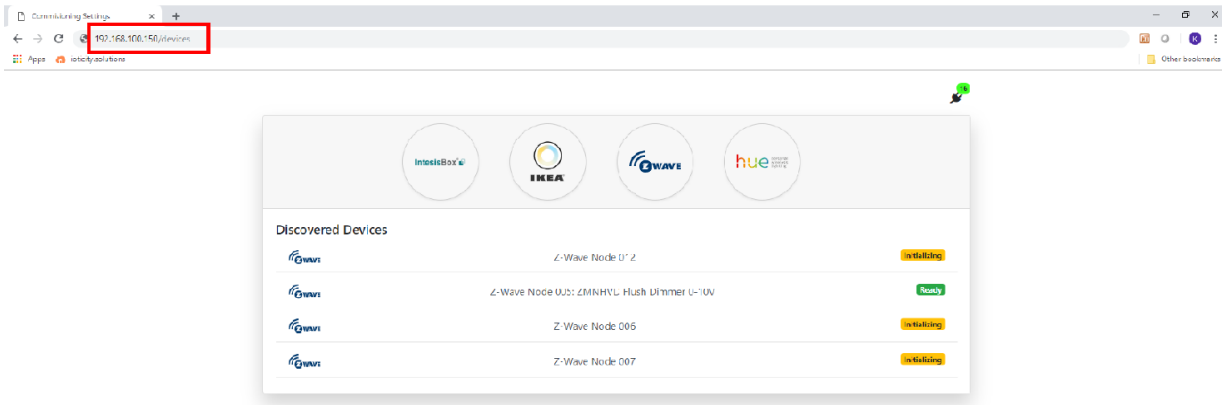


Figure 22. Device Commissioning View

To reach the gateway, the link based on the IP address extracted in 1.3.1.2 is used.

Important Notice

This document includes all the information needed in order for the selected device to be commissioned to the PARITY's cloud infrastructure. **These instructions are supplementary to the installation and technical manuals provided by device manufacturer.**

2.1 Device Commissioning Overview

The "Device Commissioning" view has three main containers.

1. The "Device Type" container, where all the compatible device types presented. Specifically, the PARITY solution is compatible with four different device types.

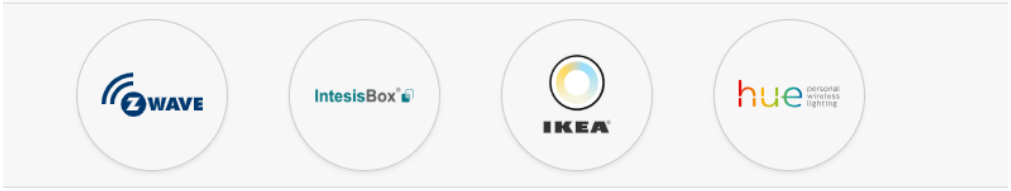


Figure 23. Compatible Device Types

a. **Z-Wave Devices**, including every Z-Wave or Z-Wave Plus devices (most of the under commissioning IoT devices belong to this category)
b. **Phillips Hue Devices**, including all the devices that are compatible with the Phillips Hue gateway.
c. **IKEA Tradfri Devices**, including all smart-lighting products provided by IKEA.

d. **IntesisBox devices**, including all the WiFi enabled HVAC remote controllers provided by Intesis.

By clicking those buttons, the respective bundle initiates the device inclusion mode. Detailed information about the inclusion of each device type can be found below.

2. The “Discovered Devices” container, where all the devices that are currently discovered by the IoT Gateway but not commissioned to the PARITY network are.

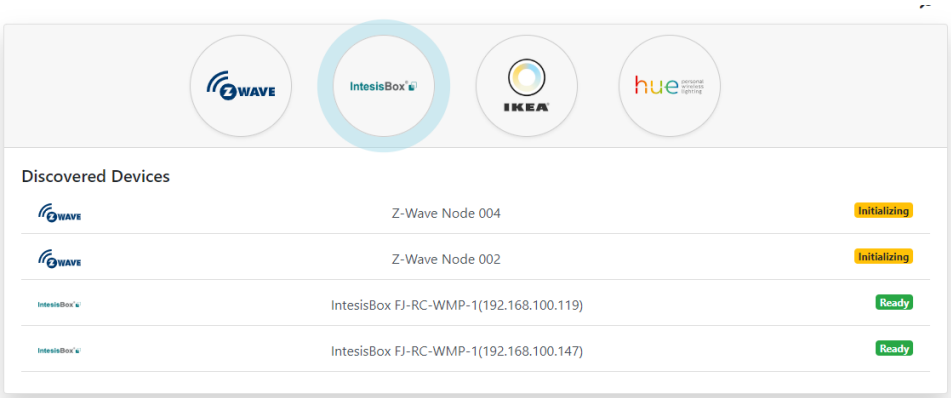


Figure 24. Four new devices discovered by the IoT Gateway

There are two possible device statuses for the discovered devices:

- **READY:** the device is ready to be commissioned to the network. The commissioning process of the device will start by clicking its name.
- **INITIALISING:** the IoT Gateway is currently gathering basic information for the discovered device. Commissioning process is not available for those devices. The user has to wait for the device to become “ready”.

3. The “Connected Devices” container, where all the already commissioned devices are presented together with their status.

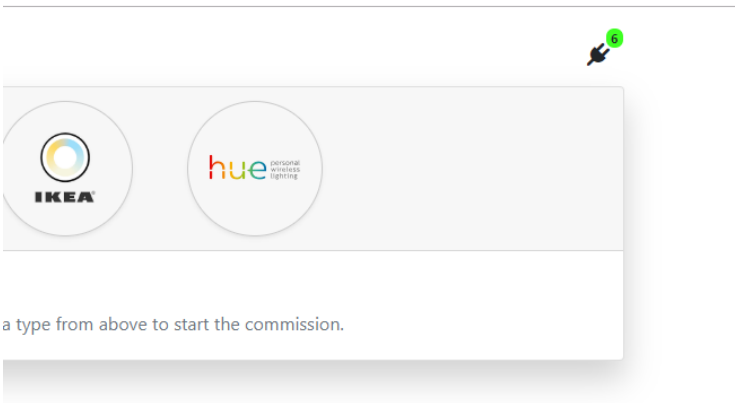


Figure 25. Click the plug at the top right corner to view the "Connected Devices” container

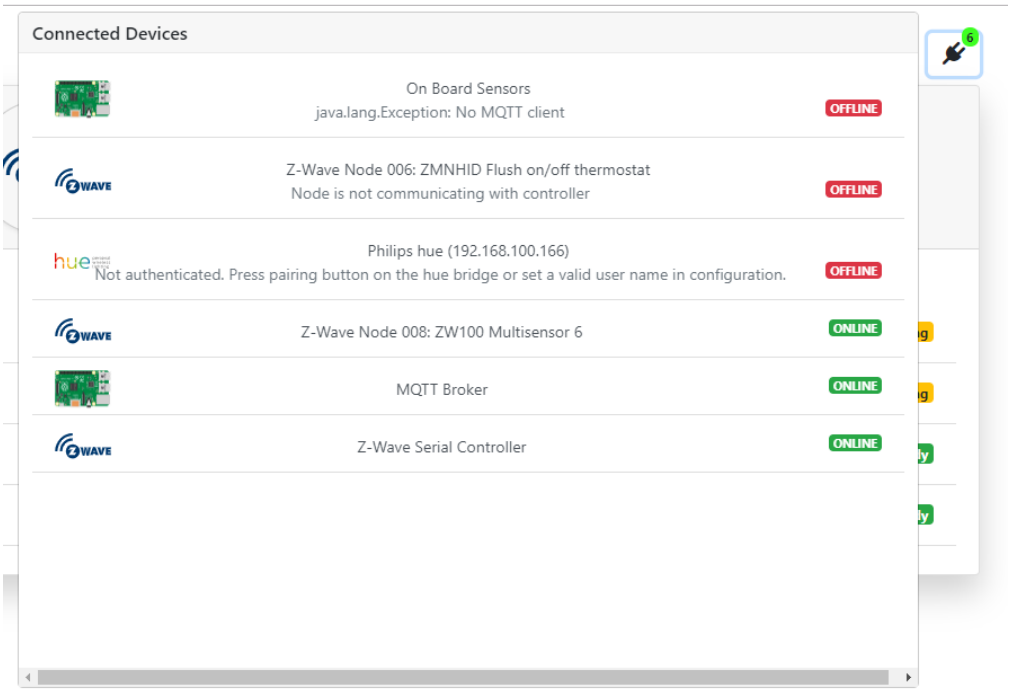


Figure 26. "Connected Devices" container

2.2 Device Commissioning Wizard

The Device Commissioning Wizard is the same for every compatible device type and includes all the necessary information that has to be given to each device in order to be properly correlated with its connected loads. ***Please fill out very carefully all the information requested otherwise all the collected data will be made non-usable.***

Important Notice
Do not refresh the page when the Device Commissioning Wizard is visible. This will cause the entire system to fail.

2.2.1 General Information Step

In this step, the gateway provides information about the selected device. For the majority of the devices used in PARITY, the user should insert a custom (friendly) label for the device. The label should be a name that will help the user to easily identify the installed device.

Click “Next” to continue.

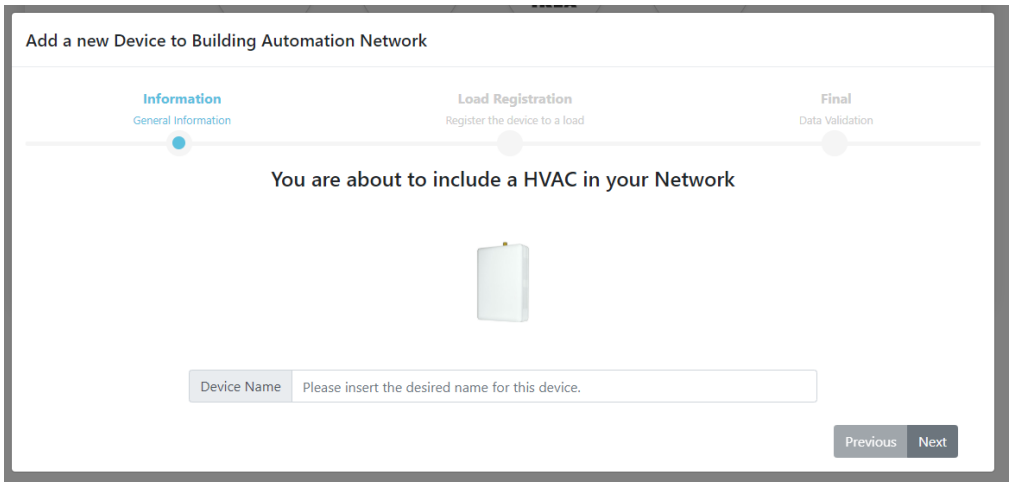


Figure 27. General Information Step

(Intesis device is about to be commissioned)

2.2.2 Load Registration Step

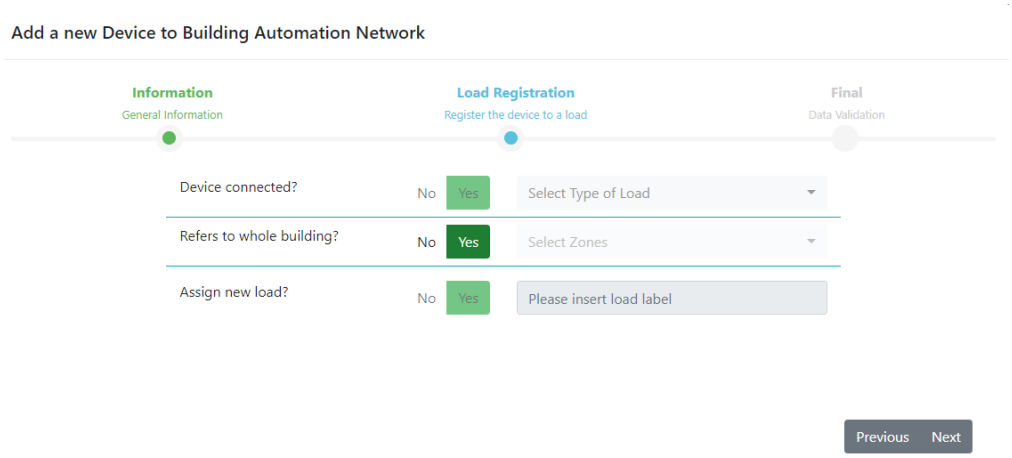


Figure 28. Load Registration Step

In this step, the user should correlate the discovered device with the appropriate load, by selecting the type of load to which the device is connected, the zone/s where the load is located to, and whether other previously commissioned devices are already correlated with that load.

The procedure includes the following steps:

1. Select one of the available type of loads
    a. The available options for this selection are dynamically allocated, in accordance to the device that is about to be commissioned. In general, there are 6 different load types:
        i. **LIGHTING**: refers to every connected device that is connected to the lighting system of the zone. (Smart Lighting Gateway, Smart Light Bulbs, Z-Wave Dimmers, Z-Wave Switches, Smart Clamps that are used to measure the energy consumption of a light circuit inside a zone, etc).

ii. **HVAC**: Refers to every connected device that is connected with an HVAC system inside the zone/building. (Smart Thermostat, HVAC Remote Controllers, Smart Switches for electric radiators, Smart radiator thermostats, Smart Plugs used to meter the energy consumption of a A/C split unit, Smart Clamps for meter the energy consumption of HVAC systems, etc).
iii. **DHW** (Domestic Hot Water): Refers to every connected device that is connected to the Domestic Hot Water System of the zone/building. (Smart Thermostat, Smart Plugs, Smart Switched, Smart Clamps/meters, Smart Flow Meters).
iv. **TOTAL_ENERGY_METERING**: refers to the connected devices that are used in order to meter the total energy consumption of the zone or the building. (Smart Clamp and Smart meters are applicable for this type of load).
v. **OTHER_LOAD**: refers to any other loads that are going to be metered and controlled inside a zone/building. (Smart Plugs, Smart Switches, Smart Clamps).
vi. **AMBIENTSENSING**: refers to any sensing device installed inside the zone/building. (Only the Multisensor is applicable for this load).
vii. **PV**: refers to every device correlated to any Photovoltaic installed in the building. (Smart Clamp and Smart meters are applicable for this type of load).

2. Select the exact location of the load by using the "Refers to the whole building" option and the "Select Zones" dropdown menu.

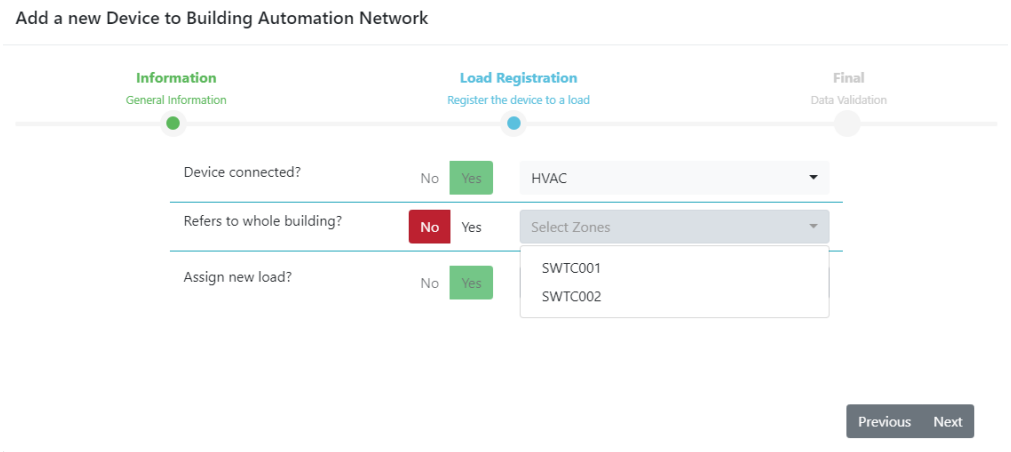


Figure 29. Select one or more of the Applicable Zone IDs

During the location selection, the commissioner will have the ability to select one or more zone IDs. The list of applicable zone IDs in this step is directly coupled if the zone IDs were selected during the Smart Box configuration/commissioning. However, in order for the list to become enabled, the user should select "No" at the "Refers to whole building" option.

3. Select Load or Assign new Load, using the selected type of device and Define location.

If the user wants to create a new load that will be correlated with this device, "Assign new Load?" should be checked, and a User-friendly label should be inserted in the respective field.

Figure 30. Register New Load Field

Otherwise, the user can correlate the device with one of the already configured loads that are of the same type with the selected load and have the same location as well. In this case the user should select "No" at the "Assign new load" option and select one of the available loads that appeared in the relative dropdown menu.

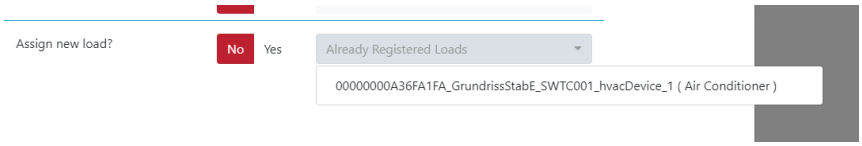


Figure 31. List of the already correlated loads

As an example, let us assume an A/C Split Unit currently installed in the SWTC001, for which the commissioner has already installed a smart plug in order to meter its energy consumption. Let an Intesis device be installed on the same A/C unit that is about to be commissioned to the PARITY network. The commissioner should insert the following data into the "Load Registration" step:

1. Type of Load: **HVAC** (The A/C unit is an HVAC device)
2. Refers to whole building?: **No** (The A/C unit located in zone SWTC001)
3. Select Zone(s): **SWTC001**
4. Assign new load: **No (As a previously commissioned device is already correlated with that load)**
5. Already Registered Loads: **Air Conditioner**

Once the Load Registration is successfully completed, click "Next" and "Save" to commit the device into the PARITY's IoT network.

2.2.3 Close Device Commissioning Wizard

If, for any reason, you want to close the wizard, please use the x button at the top-right corner (see Figure 32). To re-discover a device that has been incompletely configured, please press one of the four buttons at the top of the page (IKEA, ZWave, Hue and Intesis) depending on the device type.

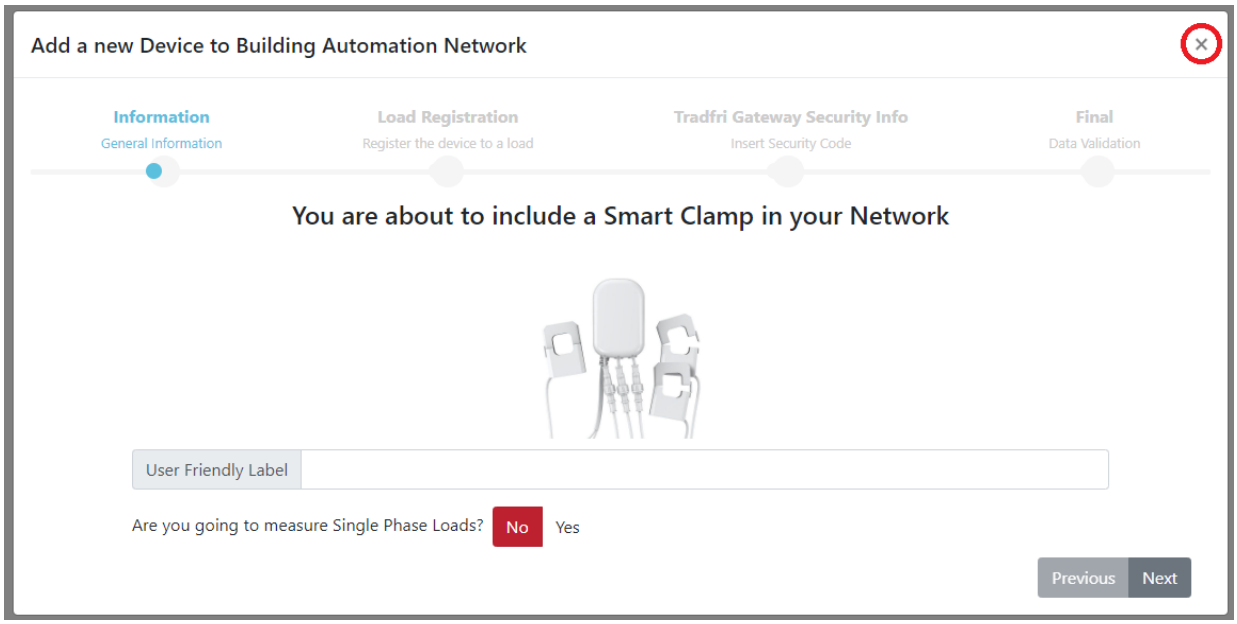


Figure 32. Device Commissioning Wizard Close Button

3. Aeotec Home Energy Meter (GEN5) Installation & Commissioning Tips

3.1 Device Configuration

In regards to the selected devices (3-phase clamp meter) and the use-cases covered from the PARITY project, there are two different valid installation topologies. The commissioning process of that device is highly dependent on the selected installation topology; therefore, a careful reading of this manual is required for the correct configuration (installation and commissioning) of that device.

3.1.1 Device Installation (Three-phase load metering)

According to that installation topology, the clamp meter will be measuring a three-phase load. Hence, the three different clamps should be connected to the relative circuit breaker according to the following schematic.

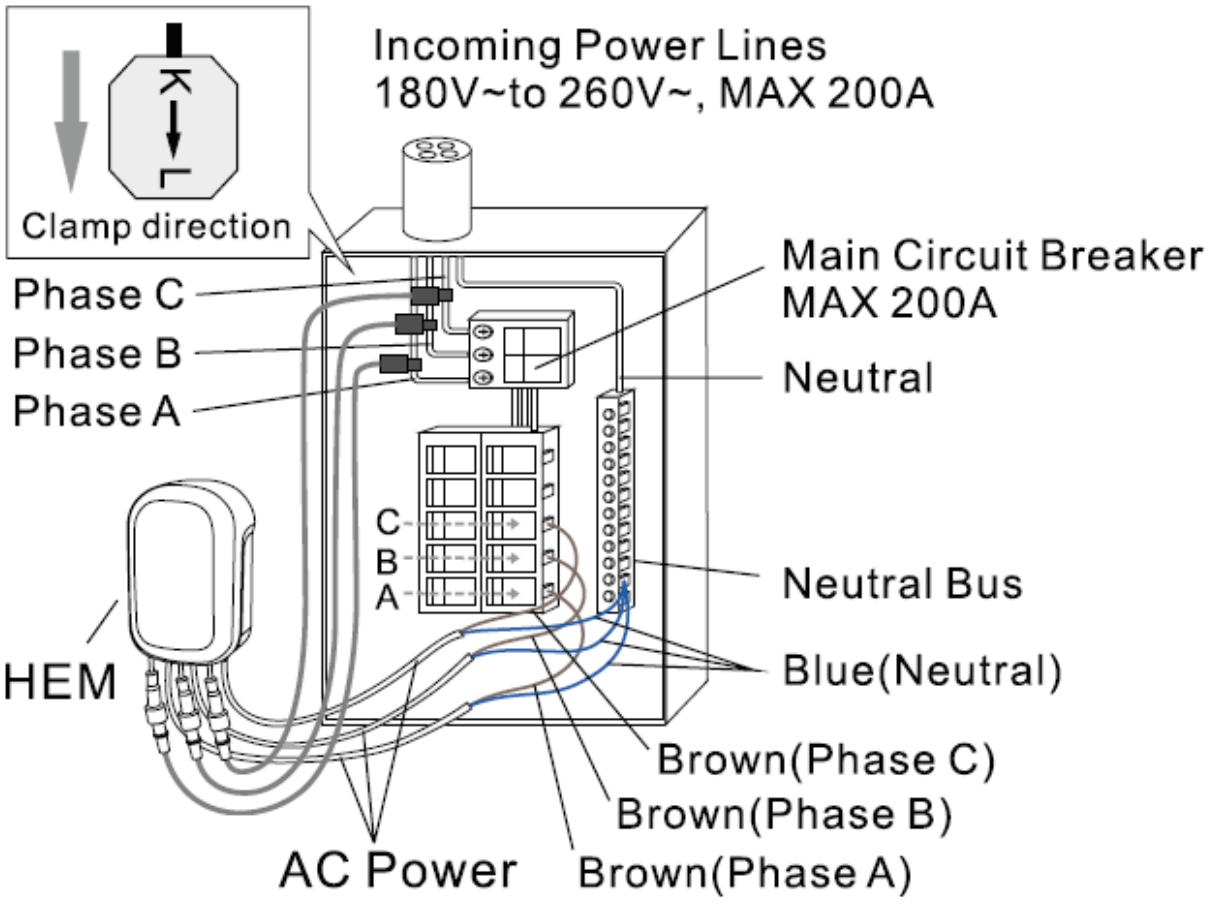


Figure 33. Three-phase installation topology

3.1.2 Device Installation (Single-phase load metering)

According to that installation topology, each clamp will be connected to an independent load in order to meter its energy consumption. Please use the following schematic for connecting, each one of the three clamps to the desired loads.

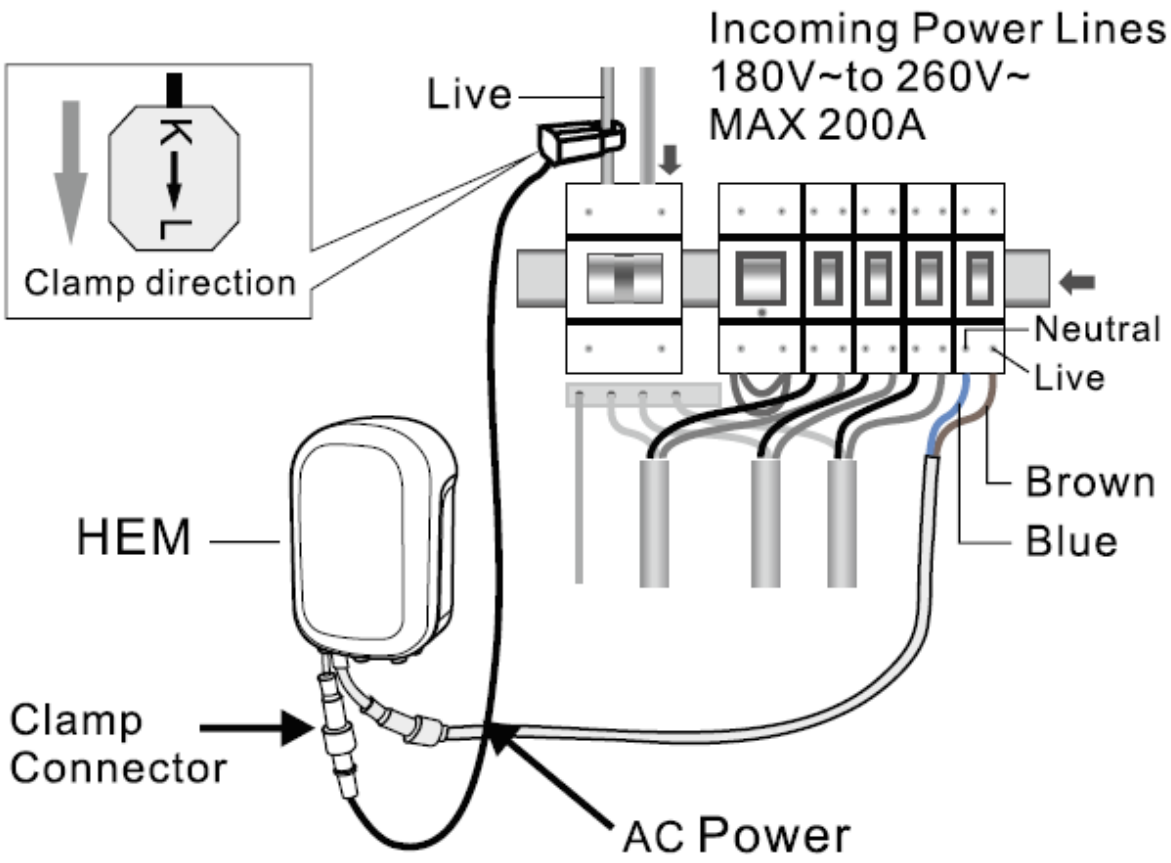


Figure 34. Single-phase installation topology

The above schematic shows how to connect each one of the clamps to its relative load

3.2 Device Commissioning

In order for the commissioning app to detect the device and allow the user to configure it according to its location and assigned load type, the device should be properly included into the Z-Wave network coordinated by the IoT Gateway. Once the device inclusion is successfully completed, the user has to configure the device through the "Device Commissioning Wizard".

3.2.1 Device Inclusion

The following steps describe the Device Inclusion process in detail.

1. Add the Z-Wave controller into "Inclusion Mode"

To do so, use the "Z-Wave" button, found in the Commissioning application.

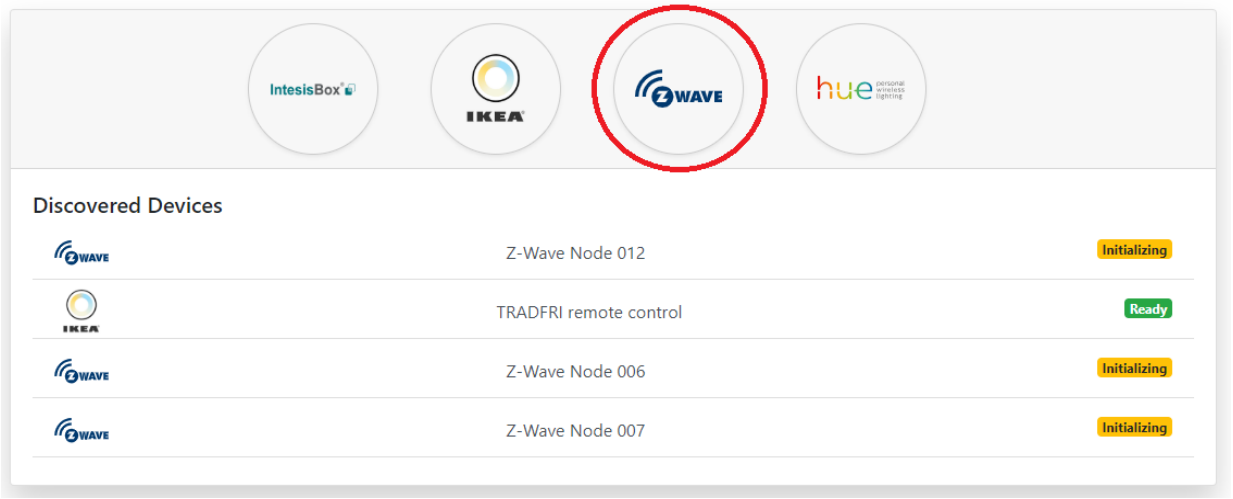


Figure 35. Press Z-Wave button to command the controller to search for new devices

2. A blue "heartbeat" loading on the perimeter of that button indicates the period that the controller is in "Inclusion Mode". This period is set to 30 sec, giving the user a 30 sec time window to perform all the necessary actions for the device to be properly included to the network.

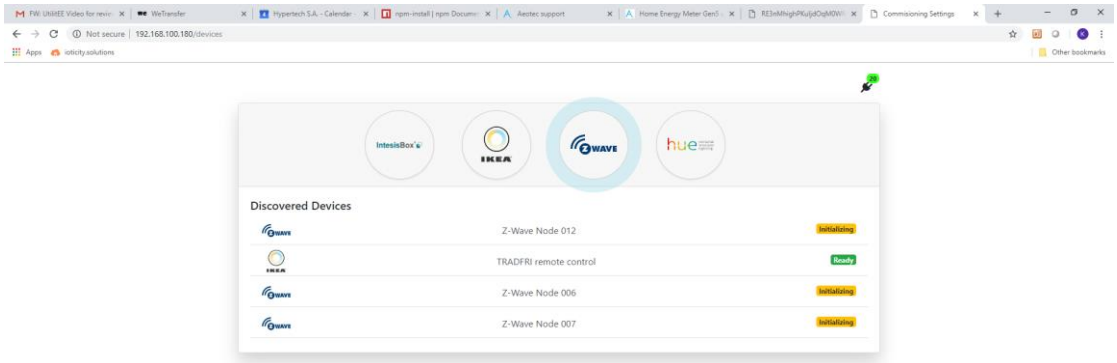
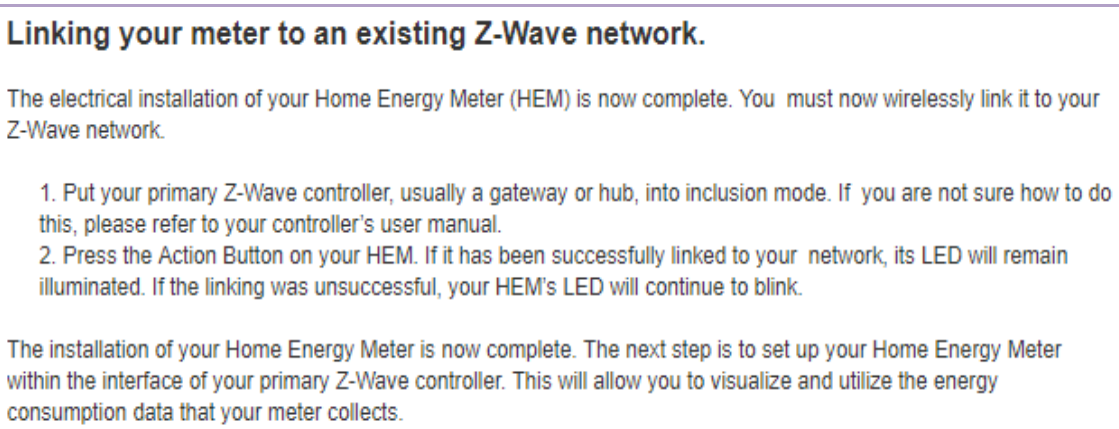


Figure 36. Heartbeat Loading indicating "Inclusion Mode"

3. Press the action button located on the back of the device and wait for a new "Z-Wave" device to be appended in the "Discovered Devices" list.

According to the User guide provided by Aeon Labs, the user is informed about the device status, from the LED indicator located on its front side.



Linking your meter to an existing Z-Wave network.

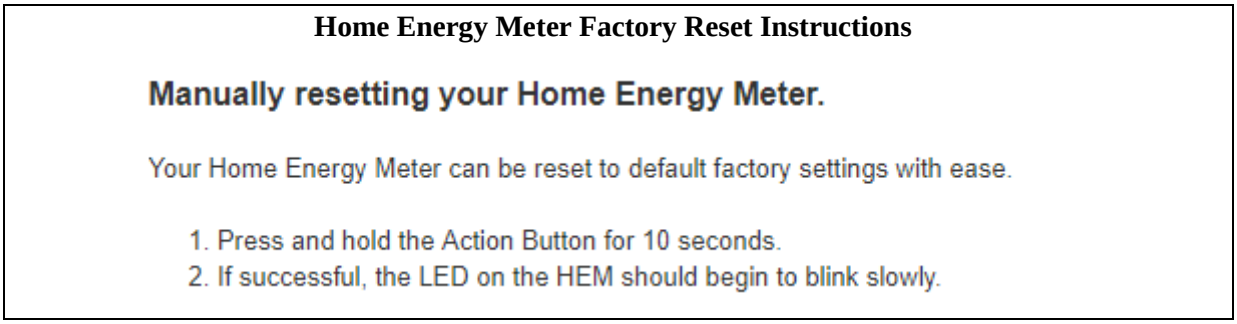
The electrical installation of your Home Energy Meter (HEM) is now complete. You must now wirelessly link it to your Z-Wave network.

1. Put your primary Z-Wave controller, usually a gateway or hub, into inclusion mode. If you are not sure how to do this, please refer to your controller's user manual.
2. Press the Action Button on your HEM. If it has been successfully linked to your network, its LED will remain illuminated. If the linking was unsuccessful, your HEM's LED will continue to blink.

The installation of your Home Energy Meter is now complete. The next step is to set up your Home Energy Meter within the interface of your primary Z-Wave controller. This will allow you to visualize and utilize the energy consumption data that your meter collects.

Figure 37. Device Inclusion Instruction provided by the manufacturer

4. If, for any reason, the device inclusion fails, the LED light continues to blink slowly and no new Z-Wave device is discovered from the application. In such case, please repeat the process starting from Step 1. If the device inclusion continues to fail, please perform a factory reset on the device and repeat the inclusion process again.



Home Energy Meter Factory Reset Instructions

Manually resetting your Home Energy Meter.

Your Home Energy Meter can be reset to default factory settings with ease.

1. Press and hold the Action Button for 10 seconds.
2. If successful, the LED on the HEM should begin to blink slowly.

Figure 38. Home Energy Meter Factory Reset Instructions

3.2.2 Device Configuration

As there are two different installation topologies for that device, the "Device Configuration Wizard" will ask you to select which is the valid topology of the clamp you want to include.

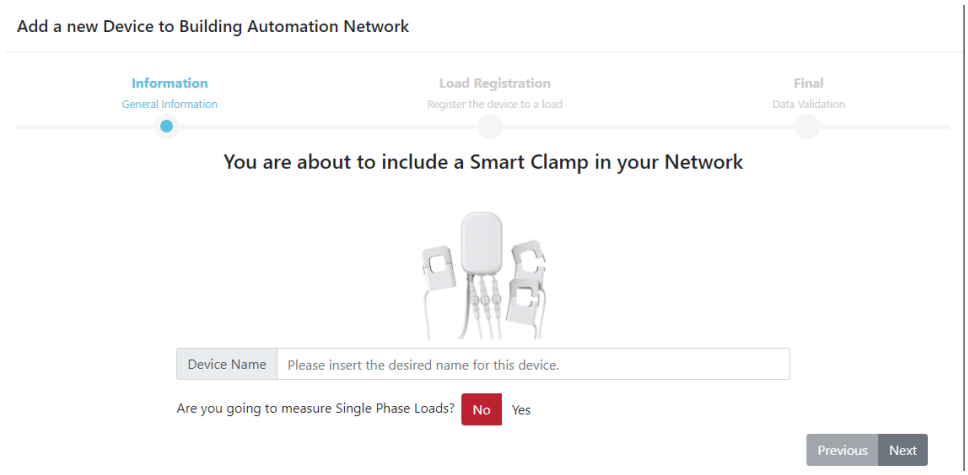


Figure 39. General Info Step of Smart Clamp

If the device is going to meter a three-phase load, the user should select "No" at the "Are you going to measure Single Phase Loads?" option. Otherwise, the selection should be "Yes".

In the first case (three phase metering), the "Load Registration" Step is the same as described above (See 2.2.2).

In the second case (single phase metering), 2 more steps added to the wizard.

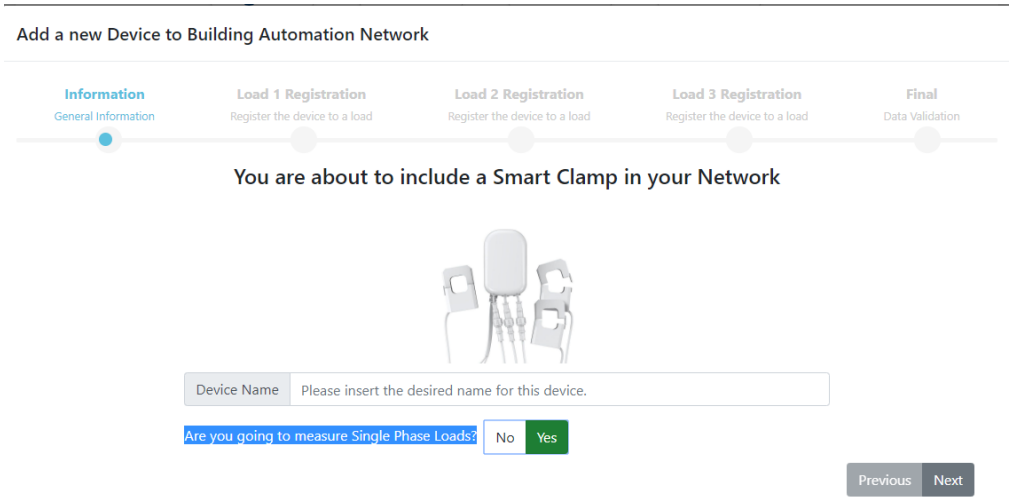


Figure 40. Device Commissioning Wizard for Smart Clamp with Single Phase load metering

As the three clamps are going to measure three independent loads, the user should register three different loads, one for each clamp. Hence, the "Load 1 Registration" step refers to the load that is metered by Clamp 1, the "Load 2 Registration" step refers to the load that is metered by Clamp 2, and the "Load 3 Registration" step refers to the load that is metered by Clamp 3. These three steps are the same with the "Load Registration" (See 2.2.2).

ANNEX II: Deployment Plans

Swiss demo-site

The detailed deployment plans for the Swiss demo-site are presented here. Information shown is only for one user but is similar for all of them.

Residential Users AEM006, AEM008, AEM014, AEM017 (similar deployment plans)

Before the on-site visit – Bring-along equipment

Local Hub / Bridge				
Device	**Quantity**	**Installer**	**Where to be installed**	**Installation Duration**
Raspberry Pi - All components listed below will be put together following the instructions in Hypertech's manual and this devices will be treated as a single device				
Raspberry Pi 4 Model B 2GB	1	DIY	Anywhere close to the z-wave devices	Plug n' play
Official Raspberry Pi 4 Model B Black Case	1			
Raspberry Pi 4 Official Power Supply 5.1V 3.0A (White)	1			
Z-Wave Z-Wave. Me RaZberry 2 Module	1			
Samsung Pro Endurance microSDHC 32GB U1 with Adapter	1			
Consumption Monitoring/control				
Device	**Quantity**	**Installer**	**Where to be installed**	**Installation Duration**
AEOTEC Home Energy meter Gen5	1	Certified Electrician	Circuit Board	20'
Additional Equipment				
Ethernet Cable for commissioning the gateway.				
Additional cables might be required for the installation of devices which are to be wired on the circuit board or with with other devices (e.g. thermostats). The exact type of wires required will be decided by the certified electrician performing the installations.				

During the installation – Deployment Plan

Note that the commissioning process must be conducted in the exact order presented below!

Installation Order	Device	Installation	Commissioning			
			Information	Load Registration		
1	Raspberry Pi	Plug n' Play Where?: At an area with good Wi-Fi connection at a close distance to where individual devices will be installed. **How?:** Set up the device following the installations of the manual provided by Hypertech	**Country:** Switzerland **Zone Type:** Residential **Zone Names:** AEM006			
2	AEOTEC Home Energy Meter Gen5	A certified electrician is required **Where?:** Circuit board **How?:** Connect each clamp of the device to a phase of the DHW supply on the circuit breaker board. Installation details in Hypertech's manual	**Device Name:** *To be decided by the commissioner **Single Phase load?:** No **Type of Load:** DHW **Refers to the whole building:** Yes **New load:** Yes **Label:** *To be decided by the commissioner			

Commercial User Municipality

Before the on-site visit – Bring-along equipment

Local Hub / Bridge				
Device	**Quantity**	**Installer**	**Where to be**	**Installation Duration**
Raspberry Pi - All components listed below will be put together following the instructions in Hypertech's manual and this devices will be treated as a single device				
Raspberry Pi 4 Model B 2GB	1	DIY	Anywhere close to the z-wave devices	Plug n' play
Official Raspberry Pi 4 Model B Black Case	1			
Raspberry Pi 4 Official Power Supply 5.1V 3.0A (White)	1			
Z-Wave Z-Wave. Me RaZberry 2 Module	1			
Samsung Pro Endurance microSDHC 32GB U1 with Adapter	1			
Aeotec Range Extender 7 - EU Socket	1			
Consumption Monitoring/control				
Device	**Quantity**	**Installer**	**Where to be**	**Installation Duration**
AEOTEC Home Energy meter Gen5	2	Certified Electrician	Circuit Board	20'
Ambient Sensing and Occupancy Sensing				
Device	**Quantity**	**Installer**	**Where to be**	**Installation Duration**
AEOTEC Multisensor 6 - Each sensor with a power supply will be treated as one device				
Aeon Labs Multisensor 6 - Z-Wave Plus (Temperature - Humidity - Light Sensor - Presence)	6	DIY	In each zone defined	Plug 'n Play
5V USB Power Supply	6			
HVAC System - Status Monitoring / Control				
Device	**Quantity**	**Installer**	**Where to be installed**	**Installation Duration**
Universal IR Air Conditioner to Home Automation Interface	6	DIY	On the wall next to the AC unit	Plug n' Play
Additional Equipment				
Ethernet Cable for commissioning the gateway.				
Additional cables might be required for the installation of devices which are to be wired on the circuit board or with with other devices (e.g. thermostats). The exact type of wires required will be decided by the certified electrician performing the installations.				

During the installation – Deployment Plan

Note that the commissioning process must be conducted in the exact order presented below!

Installation Order	Device	Installation	Commissioning			
			Information	Load Registration		
1	Raspberry Pi	Plug n' Play **Where?:** At an area with good Wi-Fi connection at a close distance to where individual devices will be installed. **How?:** Set up the device following the installations of the manual provided by Hypertech	**Country: Switzerland** **Zone Type: Commercial** **Zone Names: PACHC001CapoUTC, PACHC001UTC, PACHC001Architetti, PACHC001UfficioAcqua, PACHC001SalaRiunione**			
2	AEOTEC Range Extender 7	Plug n' Play **Where?:** At a spot in the mid distance between the raspberry Pi and the rest of the devices **How?:** Connect to power	**Device Name:** Range extender **Single Phase load?:** Yes	**Type of Load:** OTHER **Refers to the whole building:** No **Zones:** PACHC001CapoUTC, PACHC001UTC, PACHC001Architetti, PACHC001UfficioAcqua, PACHC001SalaRiunione **New load:** Yes **Label:** Range extender		
3	AEOTEC Home Energy Meter Gen5	A certified electrician is required **Where?:** Above the main power switch, near the AC outdoor unit. **How?:** Connect a clamp of the device to the main power supply of the AC unit. Installation details in Hypertech's manual	**Device Name:** *To be decided by the commissioner **Single Phase load?:** Yes	**Load 1 Registration** **Clamp 1 connected:** Yes **Type of Load:** HVAC **Refers to the whole building:** No **Zones:** PACHC001UTC, PACHC001UfficioAcqua, PACHC001SalaRiunione **New load:** Yes **Label:** Unità destra	**Load 2 Registration** **Clamp 2 connected:** No	**Load 3 Registration** **Clamp 3 connected:** No
4	AEOTEC Home Energy Meter Gen5	A certified electrician is required **Where?:** Above the main power switch, near the AC outdoor unit. **How?:** Connect a clamp of the device to the main power supply of the AC unit. Installation details in Hypertech's manual	**Device Name:** *To be decided by the commissioner **Single Phase load?:** Yes	**Load 1 Registration** **Clamp 1 connected:** Yes **Type of Load:** HVAC **Refers to the whole building:** No **Zones:** PACHC001CapoUTC, PACHC001Architetti, PACHC001UTC **New load:** Yes **Label:** Unità sinistra	**Load 2 Registration** **Clamp 2 connected:** No	**Load 3 Registration** **Clamp 3 connected:** No

Installation Order	Device	Installation	Commissioning			
			Information	Load Registration		
5	AEOTEC MultiSensor 6	Plug n' Play **Where?:** PACHC001CapoUTC **How?:**Connect to power through the power supply and place it away from any heat sources, with the front area of the device facing the room.	**Device Name:** *To be decided by the commissioner	**Type of Load:** AMBIENTSENSING **Refers to the whole building:** No **Zones:** PACHC001CapoUTC **New load:** Yes **Label:** *To be decided by the commissioner		
6	AEOTEC MultiSensor 6	Plug n' Play **Where?:** PACHC001UTC **How?:**Connect to power through the power supply and place it away from any heat sources, with the front area of the device facing the room.	**Device Name:** *To be decided by the commissioner	**Type of Load:** AMBIENTSENSING **Refers to the whole building:** No **Zones:** PACHC001UTC **New load:** Yes **Label:** *To be decided by the commissioner		
7	AEOTEC MultiSensor 6	Plug n' Play **Where?:** PACHC001UTC **How?:**Connect to power through the power supply and place it away from any heat sources, with the front area of the device facing the room.	**Device Name:** *To be decided by the commissioner	**Type of Load:** AMBIENTSENSING **Refers to the whole building:** No **Zones:** PACHC001UTC **New load:** Yes **Label:** *To be decided by the commissioner		
8	AEOTEC MultiSensor 6	Plug n' Play **Where?:** PACHC001Architetti **How?:**Connect to power through the power supply and place it away from any heat sources, with the front area of the device facing the room.	**Device Name:** *To be decided by the commissioner	**Type of Load:** AMBIENTSENSING **Refers to the whole building:** No **Zones:** PACHC001Architetti **New load:** Yes **Label:** *To be decided by the commissioner		
9	AEOTEC MultiSensor 6	Plug n' Play **Where?:** PACHC001UfficioAcqua **How?:**Connect to power through the power supply and place it away from any heat sources, with the front area of the device facing the room.	**Device Name:** *To be decided by the commissioner	**Type of Load:** AMBIENTSENSING **Refers to the whole building:** No **Zones:** PACHC001UfficioAcqua **New load:** Yes **Label:** *To be decided by the commissioner		
10	AEOTEC MultiSensor 6	Plug n' Play **Where?:** PACHC001SalaRiunione **How?:**Connect to power through the power supply and place it away from any heat sources, with the front area of the device facing the room.	**Device Name:** *To be decided by the commissioner	**Type of Load:** AMBIENTSENSING **Refers to the whole building:** No **Zones:** PACHC001SalaRiunione **New load:** Yes **Label:** *To be decided by the commissioner		

Installation Order	Device	Installation	Commissioning			
			Information	Load Registration		
11	Universal IR Air Conditioner to Home Automation Interface	Plug n' Play **Where?:** PACHC001UTC **How?:** Installation details in the manufacturer's manual. **Requirements:** Intesis must be fully functional - configure using manufacturer's manual. (click link on the left)	**Device Name:** *To be decided by the commissioner (Please Include Zone Name on Label)	**Type of Load:** HVAC **Refers to the whole building:** No **Zones:** PACHC001UTC, PACHC001UfficioAcqua, PACHC001SalaRiunione **New load:** No **Label:** Unità destra		
12	Universal IR Air Conditioner to Home Automation Interface	Plug n' Play **Where?:** PACHC001UfficioAcqua **How?:** Installation details in the manufacturer's manual. **Requirements:** Intesis must be fully functional - configure using manufacturer's manual. (click link on the left)	**Device Name:** *To be decided by the commissioner (Please Include Zone Name on Label)	**Type of Load:** HVAC **Refers to the whole building:** No **Zones:** PACHC001UTC, PACHC001UfficioAcqua, PACHC001SalaRiunione **New load:** No **Label:** Unità destra		
13	Universal IR Air Conditioner to Home Automation Interface	Plug n' Play **Where?:** PACHC001SalaRiunione **How?:** Installation details in the manufacturer's manual. **Requirements:** Intesis must be fully functional - configure using manufacturer's manual. (click link on the left)	**Device Name:** *To be decided by the commissioner (Please Include Zone Name on Label)	**Type of Load:** HVAC **Refers to the whole building:** No **Zones:** PACHC001UTC, PACHC001UfficioAcqua, PACHC001SalaRiunione **New load:** No **Label:** Unità destra		
14	Universal IR Air Conditioner to Home Automation Interface	Plug n' Play **Where?:** PACHC001UfficioAcqua **How?:** Installation details in the manufacturer's manual. **Requirements:** Intesis must be fully functional - configure using manufacturer's manual. (click link on the left)	**Device Name:** *To be decided by the commissioner (Please Include Zone Name on Label)	**Type of Load:** HVAC **Refers to the whole building:** No **Zones:** PACHC001CapoUTC, PACHC001Architetti, PACHC001UTC **New load:** No **Label:** Unità sinistra		

Installation Order	Device	Installation	Commissioning			
			Information	Load Registration		
15	Universal IR Air Conditioner to Home Automation Interface	Plug n' Play **Where?:** PACHC001Architetti **How?:** Installation details in the manufacturer's manual. **Requirements:** Intesis must be fully functional - configure using manufacturer's manual. (click link on the left)	**Device Name:** *To be decided by the commissioner (Please include Zone Name on Label)	**Type of Load:** HVAC **Refers to the whole building:** No **Zones:** PACHC001CapoUTC, PACHC001Architetti, PACHC001UTC **New load:** No **Label:** Unità sinistra		
16	Universal IR Air Conditioner to Home Automation Interface	Plug n' Play **Where?:** PACHC001UTC **How?:** Installation details in the manufacturer's manual. **Requirements:** Intesis must be fully functional - configure using manufacturer's manual. (click link on the left)	**Device Name:** *To be decided by the commissioner (Please include Zone Name on Label)	**Type of Load:** HVAC **Refers to the whole building:** No **Zones:** PACHC001CapoUTC, PACHC001Architetti, PACHC001UTC **New load:** No **Label:** Unità sinistra		