Project co-financed by the European Regional Development Fund

INTERREG MED Programme

2014-2020

ESMARTCITY

Enabling Smarter City in the MED Area through Networking

(3MED17_1.1_M2_022)

Priority Axis 1. Promoting Mediterranean innovation capacities to develop smart and sustainable growth

Specific Objective 1.1 To increase transnational activity of innovative clusters and networks of key sectors of the MED area

WP3 – Testing

Activity 3.3 – Pilot Testing

Deliverable 3.3.1 – Pilot deployment – Partner PP4

Responsible Author: **Isabel Rodríguez (PP4 - ENA)**

Project Coordinator: **Iris Flacco (LP – ABREG)**

Dissemination Level		
PU	Public	X
PP	Restricted to Programme Partners and MED Programme	
RE	Restricted to a Group defined by the Partnership and MED Programme	
CO	Confidential, only for members of the partnership and MED Programme	

1 Contents

Project co-financed by the European Regional Development Fund

1.- INTRODUCTION

The aim of this report is to present the Pilot Deployment carried out by ENA (PP4) in the municipalities of Palmela, Setúbal and Sesimbra related to smart public buildings.

This document offers a detailed presentation of ENA's pilot deployment consisting in the installation of 24 Smart Energy Metering Systems for energy consumption in 24 public buildings as well as the integration, in the same IT platform, of consumption data for 5 other buildings.

Throughout this report, it will be explained how all this information is integrated into a single solution that offers a set of features specially developed to identify consumption sources, to analyze, typify and monitor their performance in real time.

This document also describes how the data collected provides tools and information that allow municipalities automating and acting on these consumption profiles, optimizing their performance in order to reduce the final energy bill and contributing, through these efficient buildings, to a smarter city where technology is put at the service of citizens.

2.- SUMMARY OF PILOT DEPLOYMENT

2.1 MOTIVATION

Today, in Europe, buildings account for around 40% of total energy consumption and are responsible for almost 40% of total greenhouse gas emissions. The golden age of construction, together with rising expectations for space comfort, have resulted in residential, commercial and public buildings that use even more energy resources than transport services.

Project co-financed by the European Regional Development Fund

According to a document recently launched by the United Nations, 68% of the world's population will live in urban areas by 2050. Therefore, a rapid transformation of cities and buildings is needed in order to achieve greater energy efficiency in their management and services.

All new buildings should be designed with the future in mind, as it is in their initial design that the need for, and use of, energy and resources over their lifetime is largely determined. At the same time, we must not forget the rehabilitation and modernization of existing buildings. In OECD countries, around 50% of the buildings that will be used in 2050 are already constructed, so their adaptation is equally important. Digitization can be the key tool in both cases by providing an energy efficiency potential of 82% for buildings.

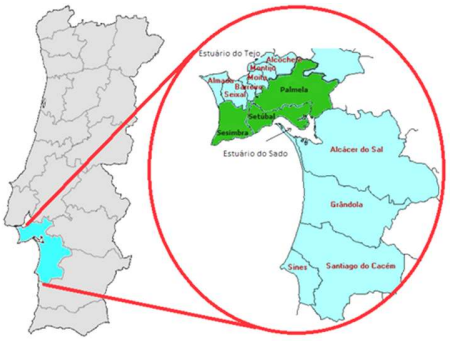
Building management technologies, for example, are one of the best tools available today as they are based on the measurement and analysis of data from all installations, allowing new opportunities for energy savings and efficiency to be discovered at all levels through the control and automation of systems. This is the motivation of ENA to carry out its Pilot Deployment.

By using energy system control in public buildings, we can add value to them making the local building network and the cities more efficient and smart. In this context, this pilot deployment aims not only to increase energy management capacity, but also to enable new products/applications, to open up opportunities for research and to communicate energy efficiency values and establish more informed policies.

2.2 PILOT DEFINITION AND GOALS

ENA´s pilot aims to install energy consumption Smart Energy Metering System in public buildings located in the Municipalities of Palmela, Sesimbra and Setúbal, municipalities that make up the Peninsula of Arrábida. There was installed energy consumption monitoring equipment and software for centralized access to the QGBTs of 24 buildings. This data, as well as the data coming from 5 other public buildings that already had a measurement system, was integrated in the same IT platform.

Project co-financed by the European Regional Development Fund



Location of ENA`s Municipalities

A system has been installed to monitor, control, optimize and test energy parameters enhancement through an ecosystem of smart devices for smart urban living. Those systems provide data for the Municipalities and their citizens.

Through the pilot project developed by ENA, it will be possible for municipalities to intervene in order to make these buildings more energy efficient, improving the provision of services to citizens, with less impact on the environment. By monitoring, analysing and systematising in real time the energy consumption data of buildings, ENA develops information essential to energy management and coordination by municipal services, allowing the planning of interventions and investments based on real needs.

The pilot project also allows the development of consumption profiles that will contribute to the optimisation of energy solutions, which are scalable and replicable in the most diverse municipal buildings, other partners and other public entities, in Portugal and in the EU.

The specific goals are:

- To obtain and systematize energy consumption data to enable energy management and coordination services
- To take advantage of affordable Information Communication Technology to monitor and analyse buildings in real time
- To plan interventions and investments based on real needs
- To prepare and deliver energy patterns to optimize the energy consumption

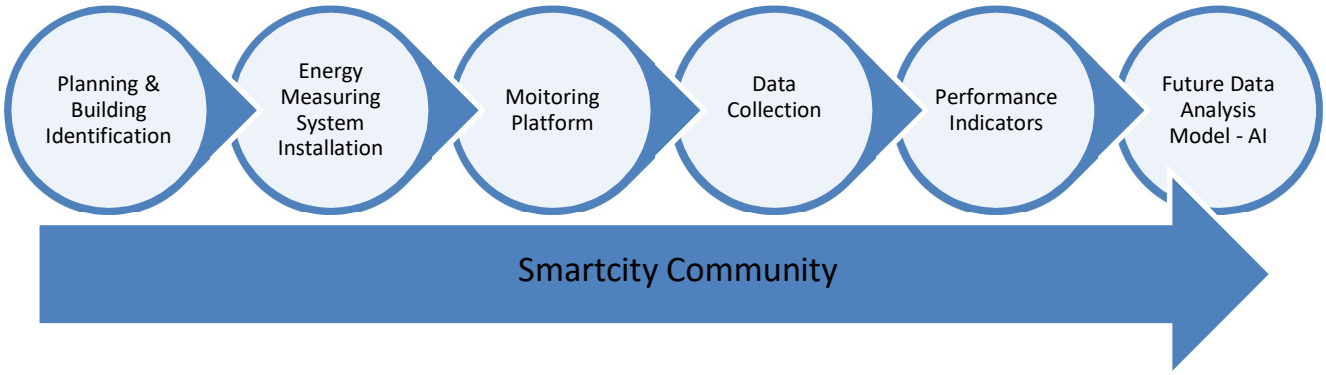
Project co-financed by the European Regional Development Fund

3.- PILOT IMPLEMENTATION

The systems implemented in the Pilot Deployment are able to monitor and analyze in real-time energy consumption in each type of building. In order to monitor and analyze data in real time, local energy metering report to a web monitoring platform, which will be able to Report on major events.

3.1 - OPERATIONAL PLAN

The Pilot Deployment Operational Plan is divided in six operational phases that are summarized in the following figure and explained below.



3.2 - PLANNING & BUILDING IDENTIFICATION

The **buildings identified and selected** for this Pilot include 4 municipal markets, 5 cultural spaces, 3 council buildings, 3 offices, 7 schools and libraries and 7 sports venues which contain offices, spaces and meeting rooms of different sizes and different characteristics. They all are public service buildings and therefore they are opened to public.

Project co-financed by the European Regional Development Fund

Setúbal

- EDP Building;
- Livramento Market;
- School EB1 das Laranjeiras;
- School EB1 da Brejoeira;
- Sport Centre “Pavilhão das Manteigadas”;
- Sport Centre “Pavilhão João dos Santos”;
- Culture Centre “Casa da Cultura”;

Sesimbra

- Sport Centre “Pavilhão Municipal de Sampaio”
- Sport Centre “Pavilhão Municipal da Quinta do Conde”
- Local Market of Sesimbra
- Local Market of Quinta do Conde
- Sesimbra´s swimming-pool

Palmela

- Municipal Library of Palmela
- Municipal Library of Pinhal Novo
- Cinema-Theatre São João
- Local Market of Pinhal Novo
- Operational Services of Palemla Municipality
- Council Chamber
- Basic School Salgueiro Maia – Pinhal Novo
- Basic School Matos Fortuna – Quinta do Anjo
- Basic School of Aires
- Palmela’s Municipal swimming-pool
- Pinhal Novo´s Municipal swimming-pool
- Cultural Centre of Poceirão

Buildings that already have a measurement system but whose data will be integrated in the same IT platform:

- Council Chamber of Palmela
- Council Chamber of Setúbal
- Fórum Luísa Todi - Setúbal
- Cinema-Theatre João Mota - Sesimbra

Project co-financed by the European Regional Development Fund

- ENA´s offices - Setúbal

Some of pilot buildings (Town hall – Palmela; Municipal Library and theatre – "Cineteatro João Mota" in Sesimbra and Municipal Culture Hall – "Casa da Baía", Setúbal)

3.3 - ENERGY MEASURING SYSTEMS INSTALLATION

Totally 24 devices has been installed for monitoring 2 physical variables: voltage and current. These measures are integrated in an IT platform together with the existent measurement system coming from other 5 buildings, making a total of 68 measuring points.

The intended **Measurement Systems** installed in 24 buildings should have the following characteristics according to the Deployment Plan:

- Energy meter placed at the entrance of the main frame, to measure the energy consumed in the building;

- Modular construction concentrator in order to allow an eventual future expansion of the measurement points. This concentrator allows the simultaneous use of several communication protocols such as KNX, MODBUS, DMX512, X10, ZiGBEE to communicate with different types of measurement devices. The concentrator communicates with the online management platform

Project co-financed by the European Regional Development Fund

using the Ethernet interface with TCP/IP protocol support, ensuring bi-directional communication in real time;

- Equipment to communicate via GSM, GPRS and Wi-fi.

- The interface equipment between the sensors installed and the software platform ("controllers") has operating autonomy, even in the temporary absence of communications.

- The interface equipment between the sensors installed and the software platform ("controllers") allows mechanisms at network security level; Support for various security standards and protocols.

- Operation and installation on the local network with all equipment ("controllers") installed on the Ethernet network infrastructure of the contracting entity, or if this is not possible, interface equipment between the sensors installed and the software platform ("controllers") with internal slot for GPRS/3G data card storage;

- They enable cloud programming, have distributed intelligence, have local processing capability, and enable remote command and monitoring;

- This equipment is equipped with remote diagnostic and screening tools, and allows firmware updates;

- All data available by measurement systems and stored on the web platform is accessible to other IT systems for the purpose of analysis and processing of information by means of open and royalty-free communication protocols, subject to appropriate authorizations.

- The system implemented guarantee the security and confidentiality of the information collected in the buildings, being made available for free consultation, only the level of information authorized by ENA in accordance with the instructions collected from the owners of the buildings to be analyzed.

- The Web platform integrates and process the information provided by the measurement systems already installed in 5 buildings.

3.4 - MONITORING PLATFORM

The Pilot Deployment aimed to allow the availability, parameterization and configuration of a **Web platform** for measuring and managing the energy consumption of the 29 buildings (24 measured + 5 already measured integrated) with the following characteristics:

- The software follows the Software as a Service (SaaS) model.

Project co-financed by the European Regional Development Fund

- Perform analysis of any type of consumption or variable, including electricity;

- Multilocal management;

- Provide real-time information (sampling frequency not exceeding 5 seconds) and historical data with a resolution of up to 5 minutes.

- No limit to data recorded in history;

- be unlimited in the number of devices to be measured;

- The solution allows the mapping of the load/consumption profiles 24 hours a day and 7 days a week, and thus allocate energy consumption to each sector, issuing reports that support and substantiate the conscious application of corrective actions aimed at better exploitation/maintenance of equipment and facilities, as well as implementing and monitoring the evolution of Energy Efficiency measures to be implemented, in order to reduce energy consumption in accordance with the different usage regimes.

- Control On/Off devices and analog devices;

- Ability to establish rules in the analysis crossing several variables and alerts according to the state of a variable or a value composed of several variables;

- Allows the sending of notifications via synoptic, email, SMS and voice;

- Allow the creation of cost centers;

- Differentiated control of energy costs, by Department, Cost Centre, by user, by equipment, and by other types of indicators to be defined by the contracting authority;

- Possibility of generating and scheduling maps and reports directly to email;

- Possibility of exporting to other formats, namely MS Excel and XML, and with information from notes stored in history

- Personalized report with the energy consumption, per user, per cost center, per equipment or other indicator to be defined by the contracting authority.

- The solution allows action on the systems equipped for this purpose;

- To be compatible with all new generation web browsers and to have interfaces for Desktop, Mobile equipment is compatible with Smart TVs or other equipment with "Web" navigation;

- To be able to be customized with regard to the creation of synoptic;

- Being able to create automatic reports;

- To be able to manage different levels of access for different types of users;

- It is housed in the cloud with a high level of connectivity;

Project co-financed by the European Regional Development Fund

- To have protection systems that allow the repositioning of information in case of failure;

- Alarm generation;

- Configurable data visualization display;

- Generation of graphics and configurable reports;

- Possibility of creating real-time notes on points of analysis of consumption graphics. These notes must remain in history;

- The platform also allows the import of billing data from suppliers of different types of energy (i.e. electricity, water, fuel or others), automatically or manually;

- The value of the licensing is per monitored variable, and unlimited as to the number of users and quantities of data stored.

The data storage service is available for a period of 5 years for all data relating to the 68 measuring points monitored.

3.4.1 - IoT SOLUTION: BEE2ENERGY PLATFORM

Bee2Energy is the **IoT Solution** from COMPTA Emerging Business contracted by ENA as operating system to connect all types of monitoring systems, devices and sensors to the internet, relating them and controlling them remotely.

This innovative solution responds to automation in the most varied areas of intervention, namely energy control in power plants and industries, alarm systems, among others.

Bee2Energy allows to control the various systems through the mobile phone, tablet or pc and making the automation accessible to all users. The information is available in real time in the Cloud.

The Bee2Energy Energy Management System allows to monitor and control the various energy consumptions used to support the decision making process of energy efficiency measures to be implemented to reduce consumption and improve the operability of production systems.

Bee2Energy allows the reduction of energy consumption through the implementation of direct application measures, without additional costs, or through the implementation of energy efficiency measures, both supported by the analysis of data obtained.

Project co-financed by the European Regional Development Fund

It is a support tool for management and decision-making, through the breakdown of energy consumption and respective costs by equipment or production sectors, consequently, it enables the allocation of energy costs to each final product, and may create a specific energy consumption indicator, which allows the evolution of energy costs in the final product to be controlled.

It is a free access system and each user can generate his account and organize his devices in the most convenient way, with full control of the system administrators. Bee2Energy allows to manage energy easily and effectively. It allows monitoring and remote action through any mobile device. With the integration of this information the Bee2Energy can be programmed to operate the devices autonomously.

Supported by the maxim "what is not measured, cannot be managed", this Platform is a very useful tool for:

- the administrator and financial director of the building, providing the evolution of energy consumption and values and the KPI (Key Performance Indicator) of production.
- the technical management team, allowing to provide data that characterize the energy profile of the building consumption, fundamental for the development and implementation of specific actions to reduce energy consumption and providing important indicators.

In addition, Bee2Energy provides the technical management team with the necessary elements to define a proactive and intelligent energy strategy, from planning the operation of the equipment according to the time period of electricity invoicing to an efficient programming of the activation of the various equipment, based on its consumption identified as load and standby.

The use of a screen (Wallboard) allows users of the buildings to be provided with visual information on their consumption and savings.

Below are some of the advantages of the solution:

- Key in hand solution that is easy to use and includes:
    - o Energy monitoring equipment + software;
- Knowledge of the current load profile;
- Translation of the energy language into the language of the user;
- Evaluation of the behaviour of the monitored equipment;
- Information at the moment that allows the assessment of anomalous behaviours;
- Historical information to verify potential points of improvement;

Project co-financed by the European Regional Development Fund

- Paradigm Change (Estimated Fixed Cost to Real Variable Cost);
- Holistic vision of energy resource management;
- Operational optimization;
- Learn and generate knowledge through best practices applied;
- Standards monitoring;
- Application of automation rules;
- Simulation;
- Reduction of energy costs;
- Anticipation of Critical Problems - Alarm;
- Balanced Centricity - Benefits and different functionalities for multiple stakeholders;
- Co-creation of value between different stakeholders (Citizen, Operations Manager, Manager, etc.).

These advantages make it possible to achieve the following objectives:

- Reduction of energy consumption and cost, in an estimated percentage based on real cases that can go up to 25%;
- Internal Division by area of Energy Consumption (Equipment, Cost Centre by service, etc.);
- Real use of differentiated energy plans;
- Tariff Change Decisions based on real data models (Custom-made Fact).

3.4.2 - DESCRIPTION OF FUNCTIONALITIES

Tariff Management

- Possibility of creating tariffs (market or specific per customer) and electricity contracts allowing the visualisation of real costs associated with consumption.

Entity Management

- Possibility of creating entities in order to associate users, manage accesses and aggregate common systems and parameterizations.

- Management of groups of and users in an entity and their access profiles.

- Possibility of creating user groups and associating them to an entity.

Project co-financed by the European Regional Development Fund

- Management of systems and accesses in an entity.

- Possibility of creating systems and respective accesses to it in an entity.

Functional Organization

- Possibility of visualization of information of an entity in a hierarchical way according to any metadata of interest to the Organization.

Category management:

- Possibility of creating categories in order to simplify and standardize the association of devices and group the visualization of information. This management can be done at the level of an entity or at the level of the user.

Production units:

- Possibility of creating metrics/KPIs in order to enable the availability of consumption and respective costs per unit of production in an entity.

Dashboards:

- Creation of personalized dashboards with the possibility of viewing all information on consumption, costs, alarms, weather, online news and production units.

Wallboards:

- Creation of pre-defined and adapted wallboards for availability in specific locations through FHD monitors prepared for the exterior.

Programming:

- Creation of programs with the possibility of checking conditions (and/or), actions, alarms, execution period and execution exceptions (example: holidays).

- Possibility of sending alerts by mail, mobile app, or sms.

Project co-financed by the European Regional Development Fund

Monitoring:

- Visualization and comparison of information in various areas, categories, indicators and devices, through energy or economic units).

- Possibility of creating annotations and exporting reports by date intervals.

Control:

- Possibility of direct action on devices (e.g.: turn on, turn off, set points).

Indicators:

- Creation of personalized indicators for complex monitoring of consumption.

System configuration:

- Association of devices to the respective types, categories, production units and electricity contracts.

3.5 - DATA COLLECTION

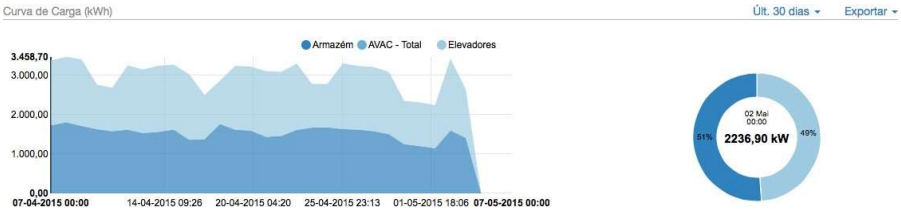
After the integration of the measuring system to the Bee2Energy platform, each device started sending telemetry and status data in real time.

The data collection provides the full overview of the Smart Building, statistics, trends and it is used to analyse the collected dataset for current and future optimization in manual and automatic decision making and resources management. Some functionalities of the Data Centre and its software solutions are presented in the following figures taken from the operating system.

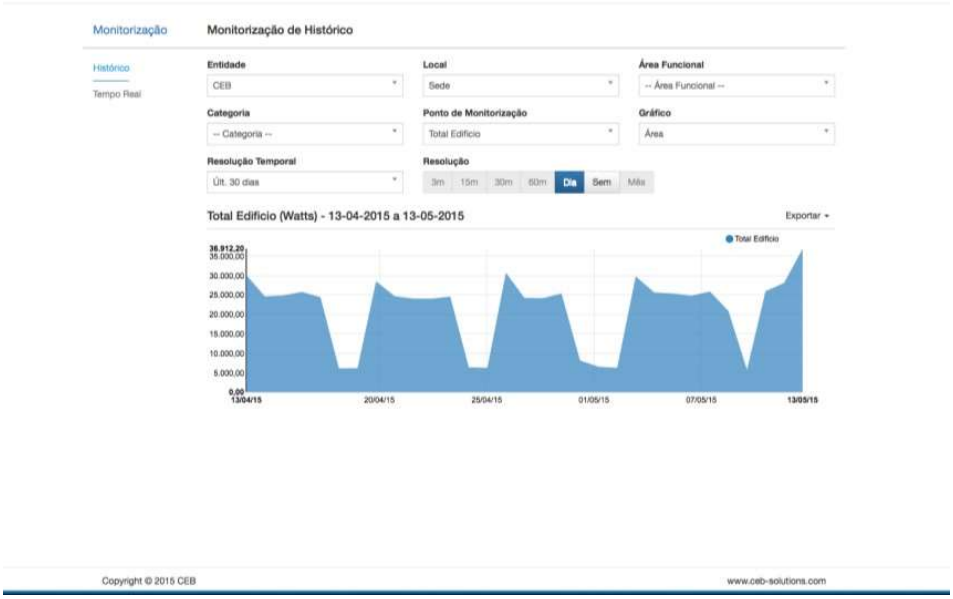
The information presented in the application is segmented as follows:

Project co-financed by the European Regional Development Fund

Load curve: information about the consumption result of a given month, week, day or time interval selected by the user;



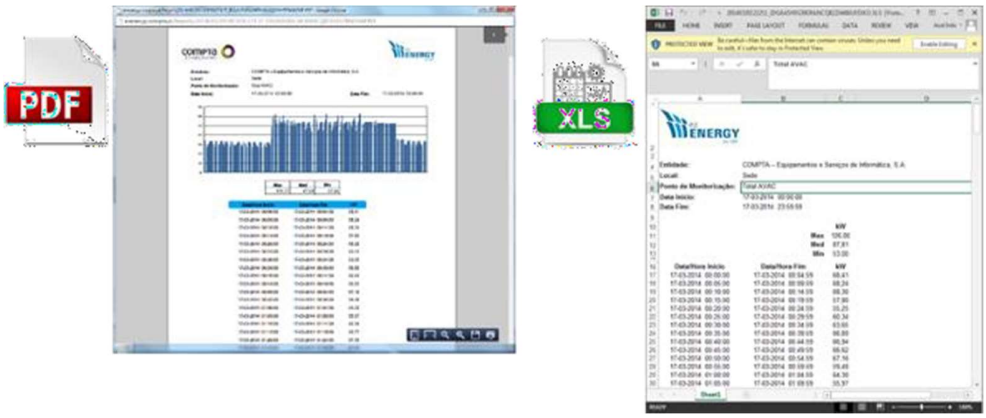
Real-Time: Real-time information of the monitoring information of the defined monitoring points;



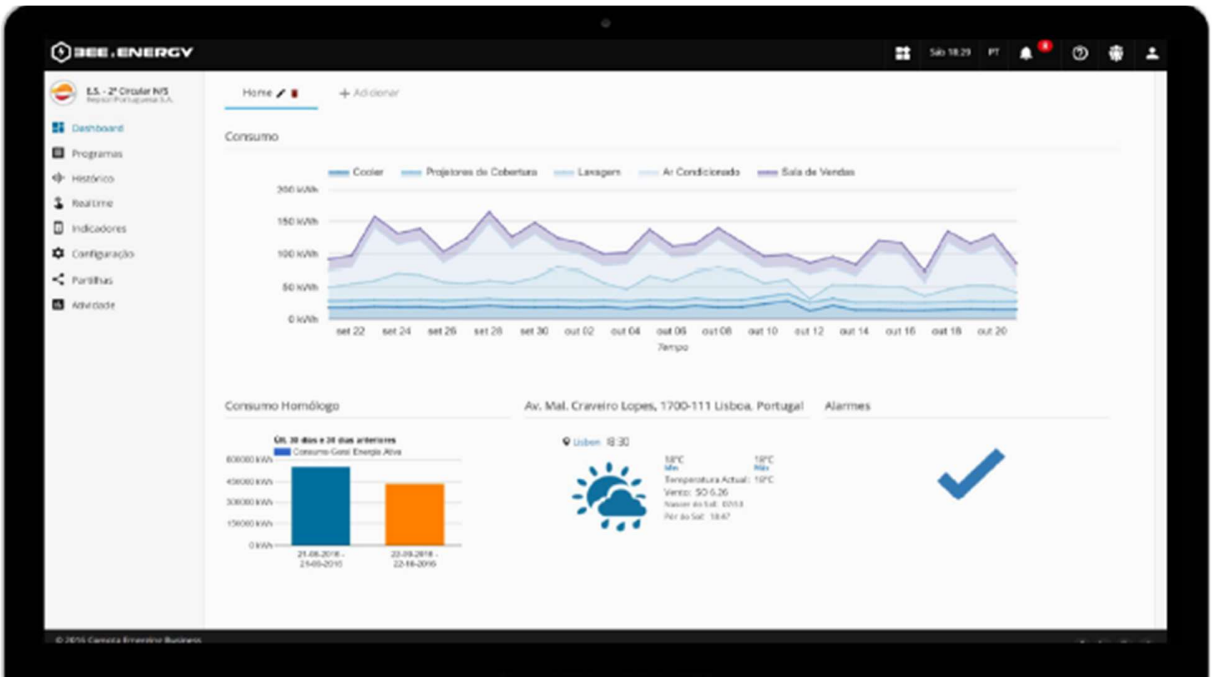
Project co-financed by the European Regional Development Fund

History: Information according to search criteria that allows the evaluation of the contributions of each of the points that make up a given Indicator.

Additionally the application provides in excel and pdf format a set of reports on the information that is being viewed.



Project co-financed by the European Regional Development Fund



Initial dashboard

Organization and Management DashBoard. Screen with analysis tables and KPIs.

Project co-financed by the European Regional Development Fund

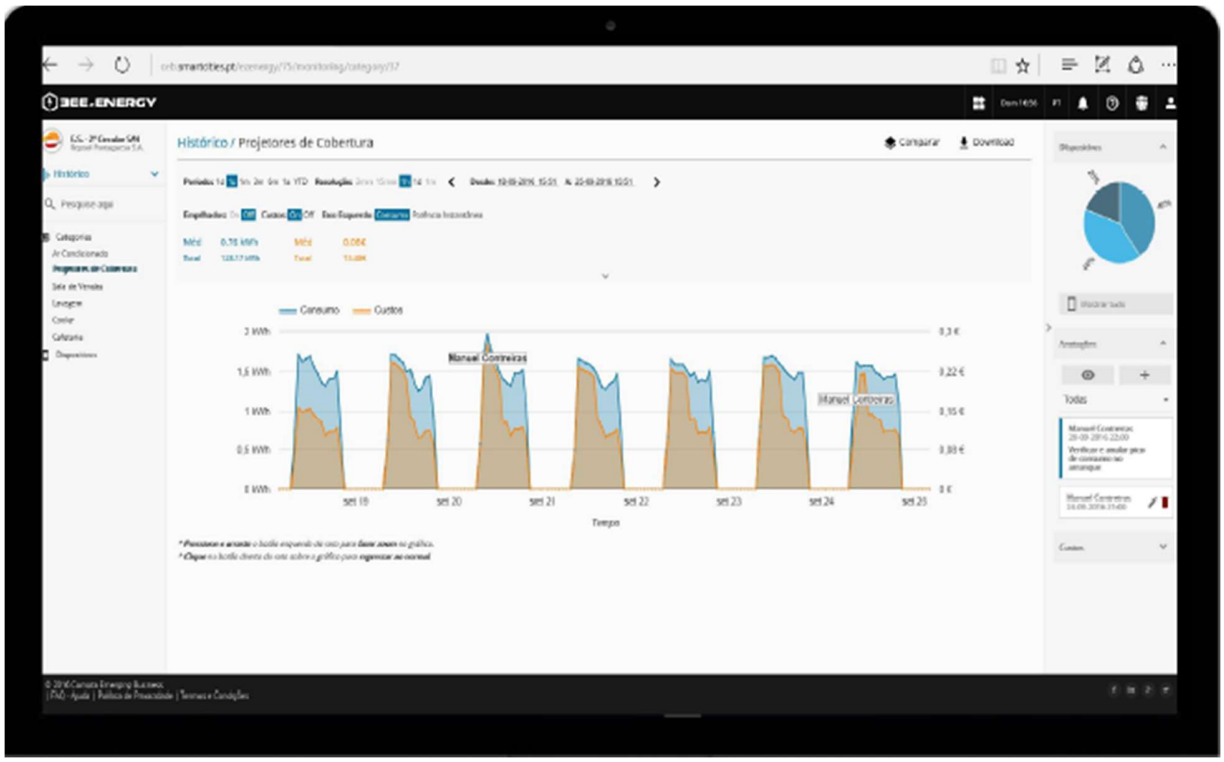
Historical Consumption

Information based on history, totally configurable in period and in the system or subsystem.

Consumption of the various subsystems or areas for periods of time configurable and comparisons of inter-period consumption counterparts.

Verification in detail of subsystems in certain period and possibility of check active alarms.

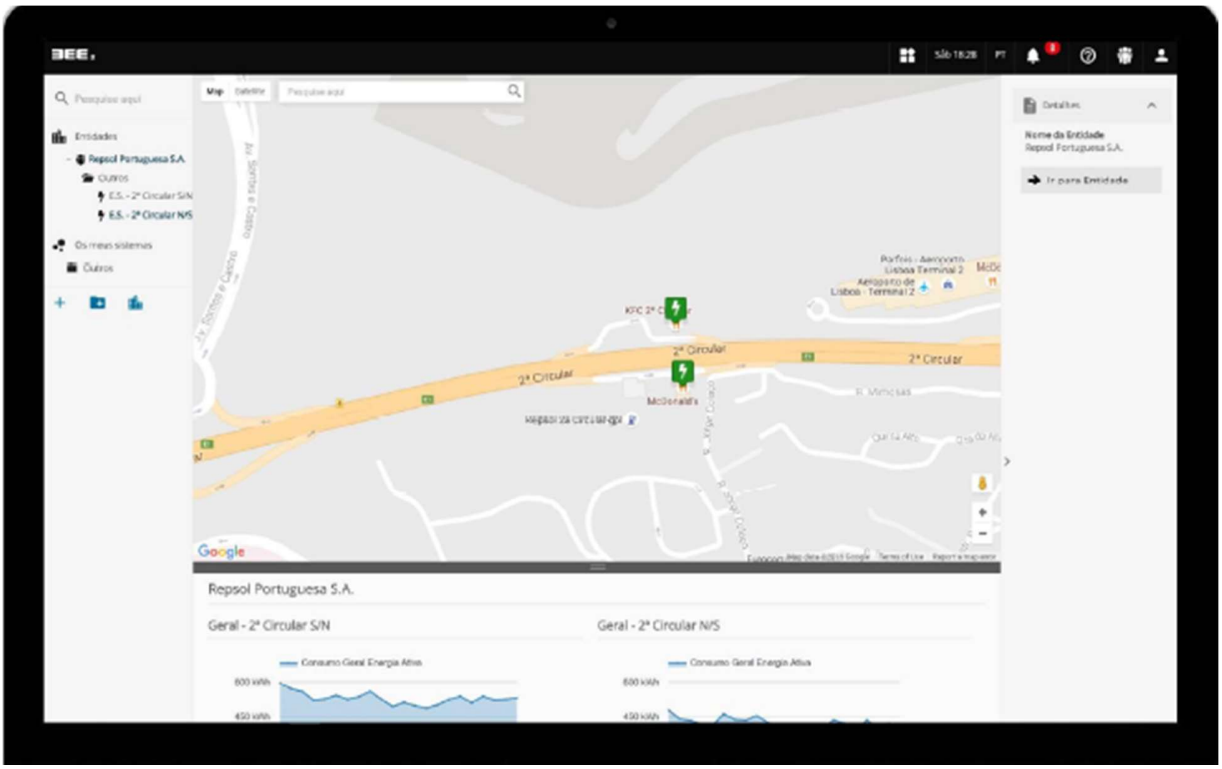
Project co-financed by the European Regional Development Fund



Interactive Comparative Analysis

Comparative analysis between points of consumption, with interactive analysis of history, real-time annotation, and export of reports.

Project co-financed by the European Regional Development Fund

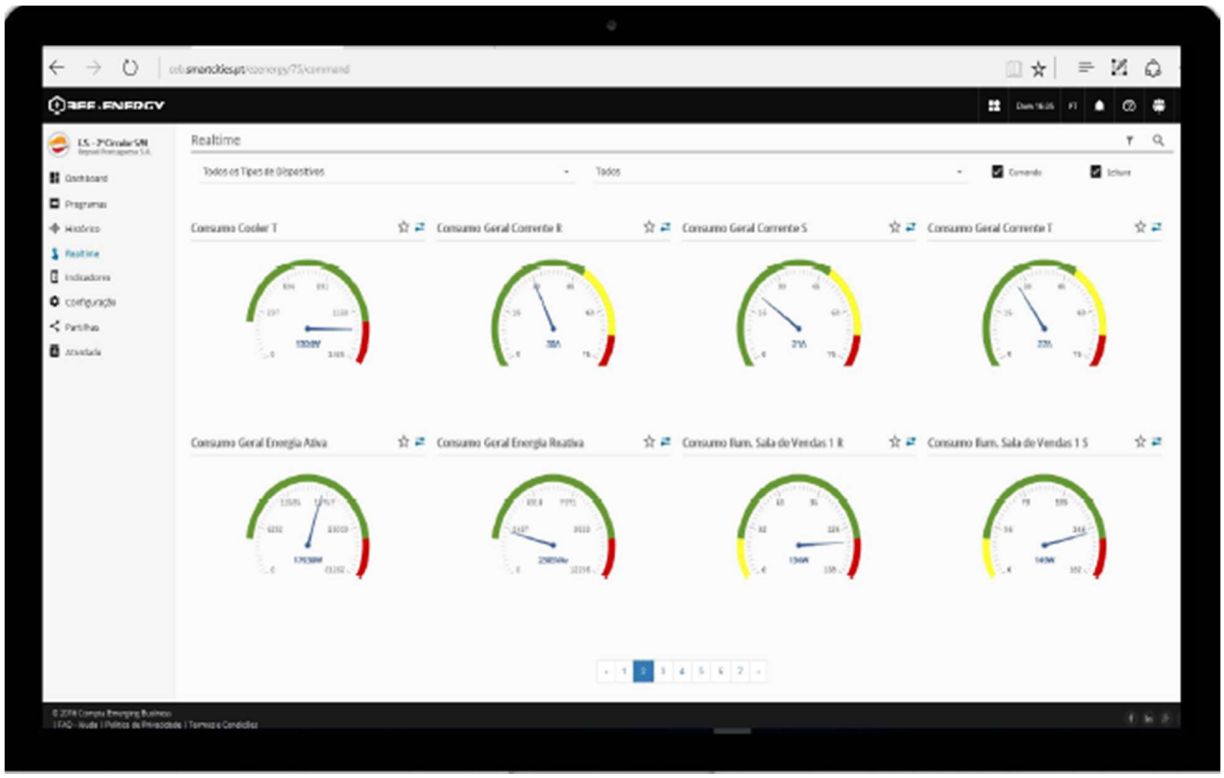


Simultaneous site management

Information based on history, totally configurable in period and in the system or subsystem.

Assessment in simultaneous of several installations or points of consumption.

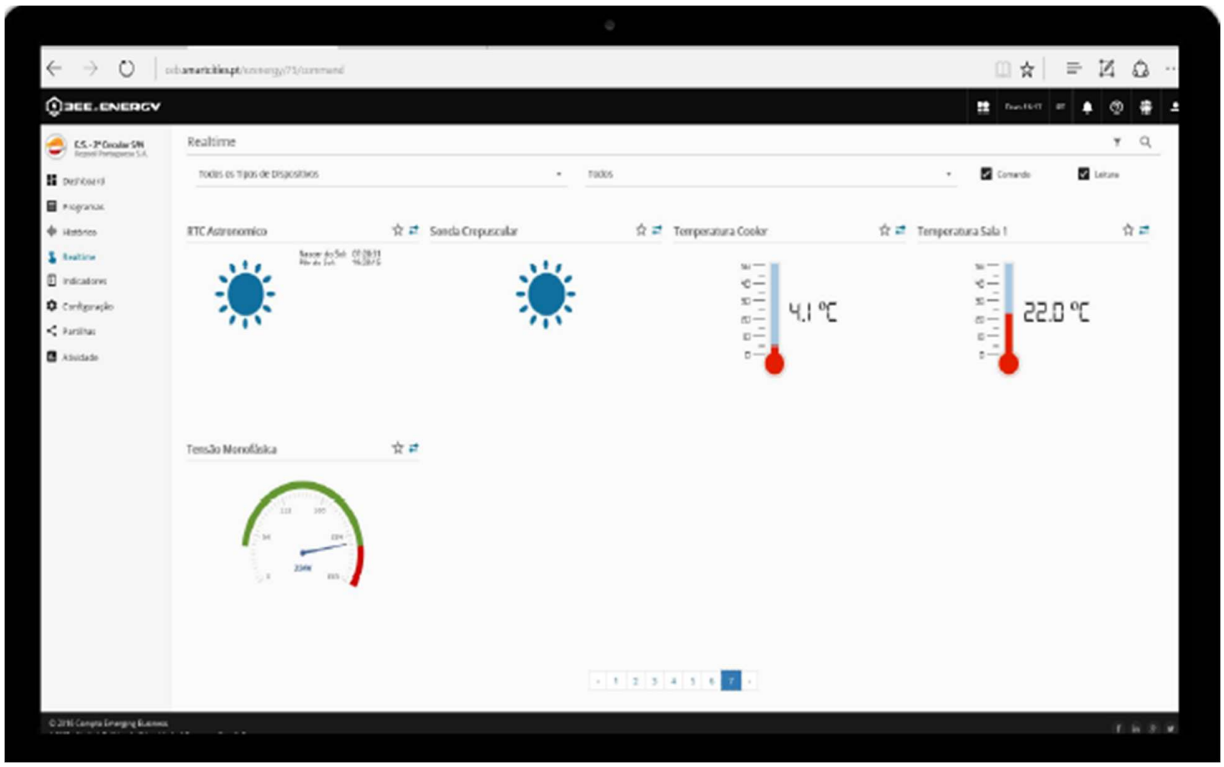
Project co-financed by the European Regional Development Fund



Real Time

Control of several consumption sensors in real time with alarming and management of set points in real time.

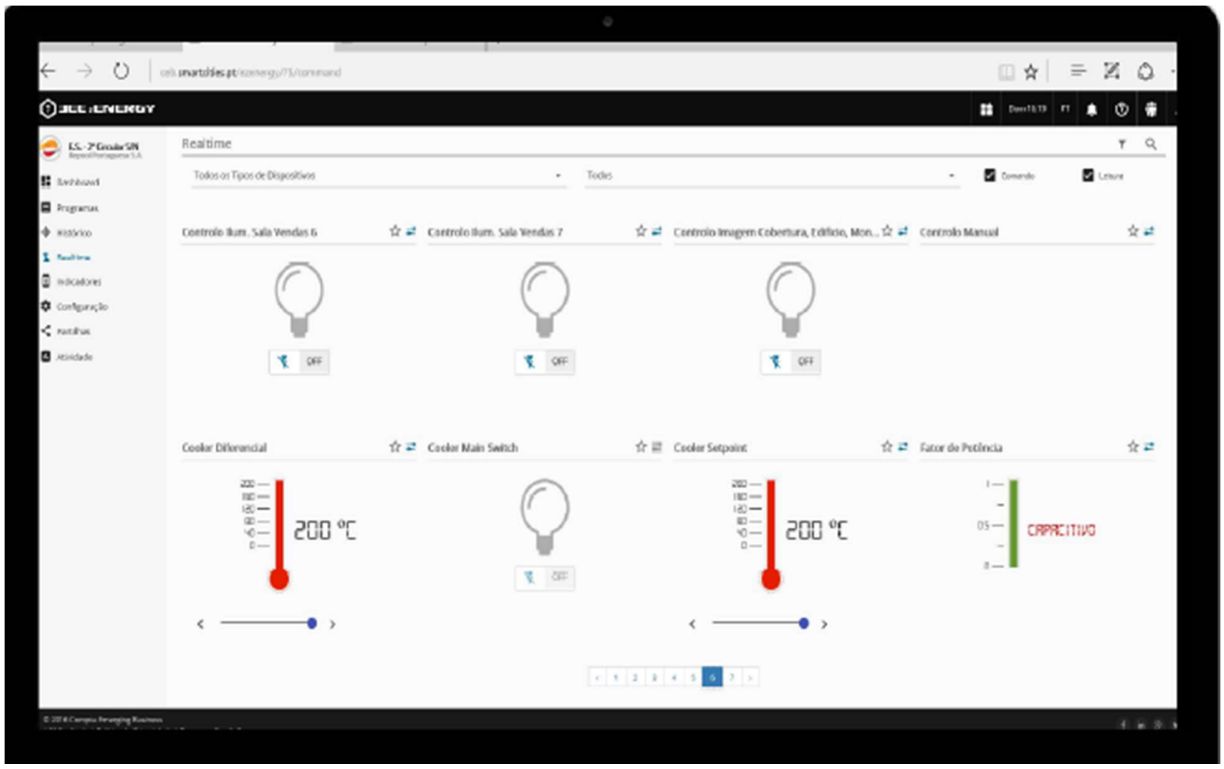
Project co-financed by the European Regional Development Fund



Real Time

Control of several sensors – Probe Twilight, Astronomical Clock, Coolers, Single-phase voltage.

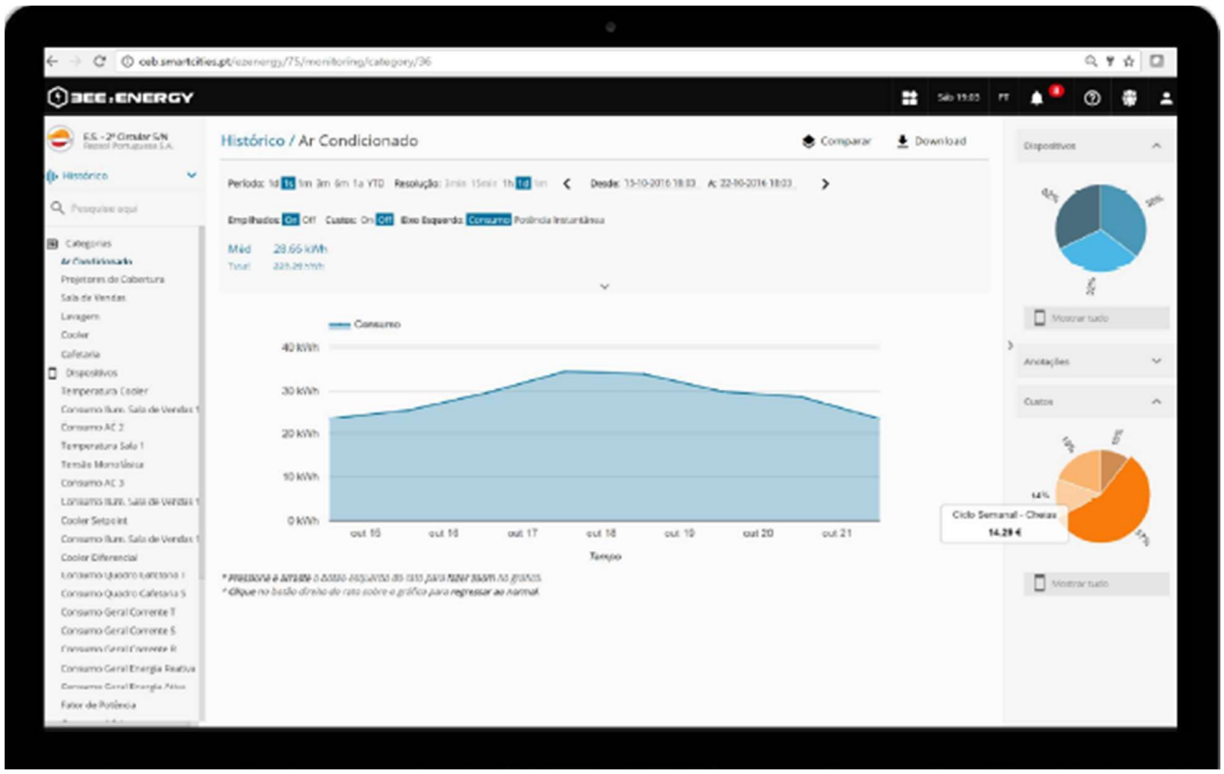
Project co-financed by the European Regional Development Fund



Real Time

Control of several sensors: Temperature, Factors of power, lighting

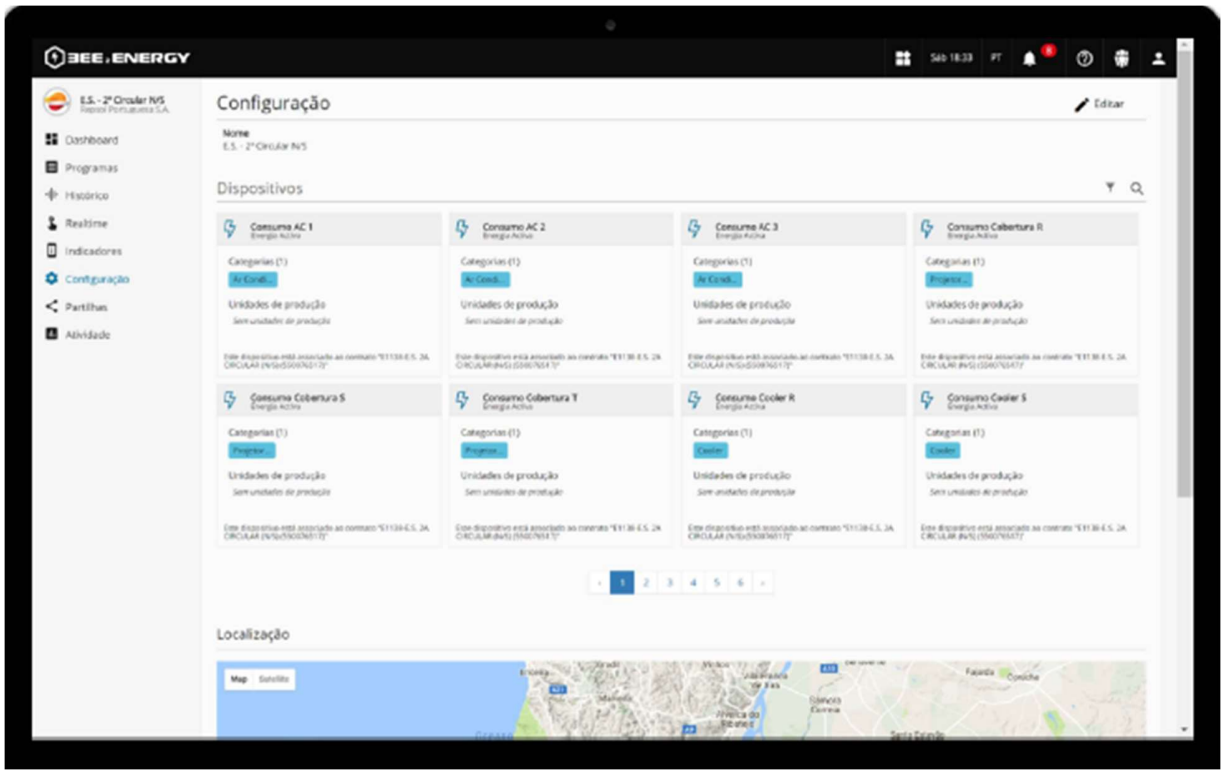
Project co-financed by the European Regional Development Fund



Costs and Tariff Management

Association of Gateways installed and sensorization, according to consumption category / areas of consumption. Total capacity of configuration.

Project co-financed by the European Regional Development Fund



System Configuration

Association of Gateways installed and sensorization, according to consumption category / areas of consumption. Total capacity of configuration.

Project co-financed by the European Regional Development Fund

3.6 - PERFORMANCE INDICATORS

INDICATOR	DEFINITION	CHARACTERISTIC	REFERENCE VALUE BY TYPE OF BUILDING
CME	Ratio between the cost of the energy bill and the active energy consumed	This ratio allows to assess which buildings have the best unit cost of energy consumed	
LOAD FACTOR	Ratio between the average power and the contracted power	This indicator allows to evaluate the use of the installation's power, which is better the higher its value	Reference Value for municipal buildings = 0.15 Reference Value for School buildings = 0.23
CPA	Ratio between the monthly consumption of electricity and the useful area	This indicator determines the daily electricity consumption of the building per m2 of floor area. The lower its value, the more efficient the building will be)	Reference value for municipal buildings = 0.20 kWh/m2.day. Reference value for School buildings = 0.24 kWh/m2.day.
CPU	Ratio between the monthly consumption of electricity and the number of users	This indicator applies to service buildings and quantifies the electrical energy consumption of the building per occupant and the lower the value, the more efficient the building will be.	

Project co-financed by the European Regional Development Fund

3.7 - FUTURE DATA ANALYSIS MODEL – ARTIFICIAL INTELLIGENCE (AI)

The implementation of ENA´s Pilot is based on sharing information and knowledge about intelligent buildings and aims to enable new products/applications, increase energy management capacity, open opportunities for research, make buildings more efficient, communicate energy efficiency values and establish more informed policies.

Thus, ENA´s pilot deployment is the starting point for the future development of data analysis models that make these buildings more intelligent through artificial intelligence (AI). In this framework, the pilot contributes to the improvement of the innovation capacity of the Municipalities in its area of intervention, through the creation of an innovation ecosystem that involves companies, research centres, academia and public authorities, creating in this territory the necessary conditions to implement the Smart City concept. Municipalities will not be mere recipients of technological innovation, but rather active elements of an ecosystem where technology is placed at the service of citizens.

4 - ARCHITECCTURE OF PILOT DEPLOYMENT

The Bee2Energy solution in which the Pilot deployment is based consists on the following components:

- Measuring equipment: Equipment placed on the customer's electrical panel in order to collect energy information that can be monitored and controlled;
- Monitoring software: Application with access via browser, PC, tablet or smatphone to verify the information collected;
- General Indicators Wallboard: Information to be presented to a community of users, whether internal or external to the CLIENT.

Project co-financed by the European Regional Development Fund

The aim of this approach is to present a turnkey solution, which allow in a first phase the collection and processing of energy information and translate it into the current language of the client. In a second phase, it enhance the initial investment made and allow the collection of other units of measurement and performance if the CLIENT deems it necessary.

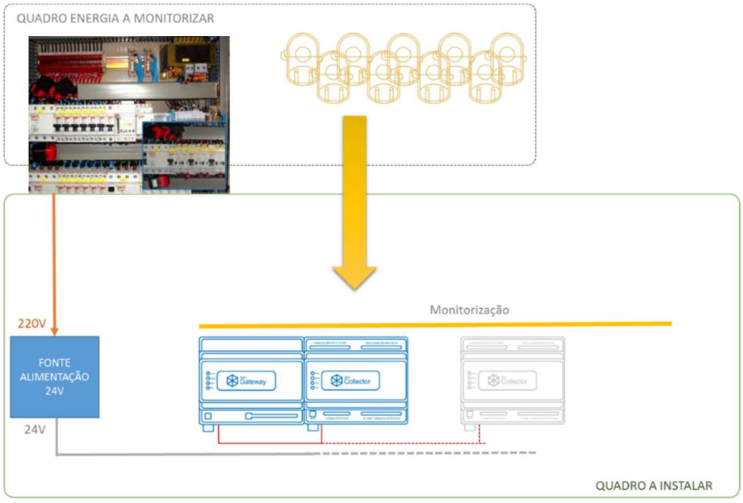
4.1 - MEASURING EQUIPMENT

The Bee2Energy solution uses a set of equipment from the manufacturer DOMATICA that present the following main components:

- MONITORING OF CIRCUITS

The following figure shows the equipment architecture for monitoring Energy Consumption in the circuits monitored.

Project co-financed by the European Regional Development Fund



THREE-PHASE CIRCUITS

3 monitoring inputs are used to monitor the equipment architecture for interconnection of each electrical panel to be monitored.

SINGLE-PHASE CIRCUITS

It is used 1 monitoring input of the equipment architecture for interconnection of each electrical panel to be monitored.

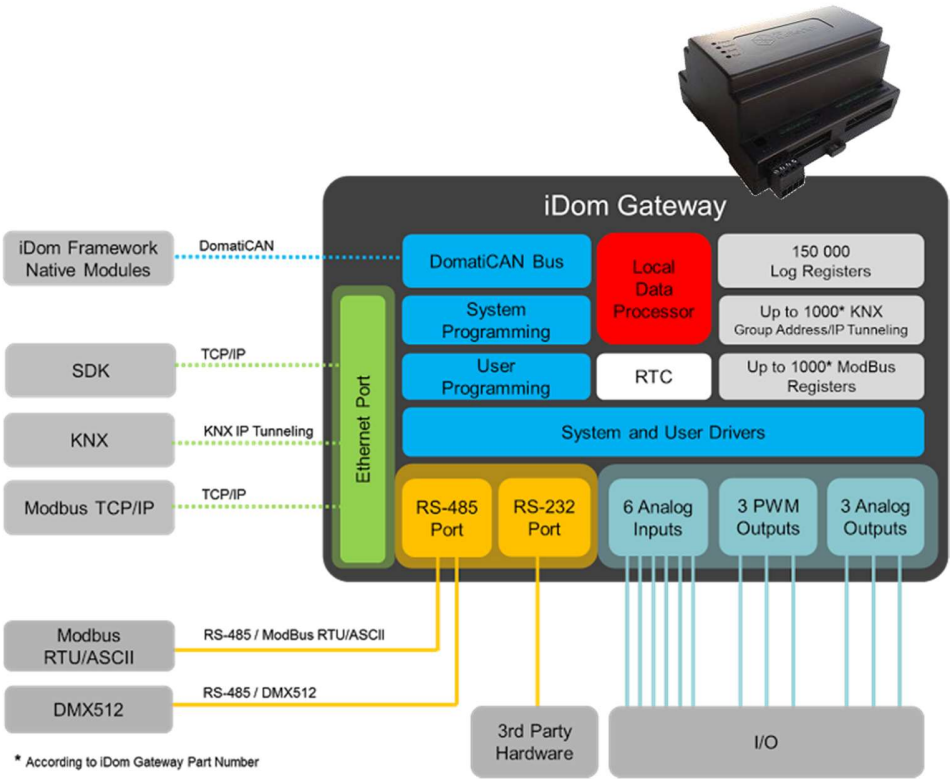
Parameterization of rules is done through the application management profile. In this way it is possible to define rules autonomously. An initial setup includes:

- Creation of location data;
- Registration allocated to the project;
- Monitoring Points

Project co-financed by the European Regional Development Fund

- GATEWAY AND COLLECTOR IDOM

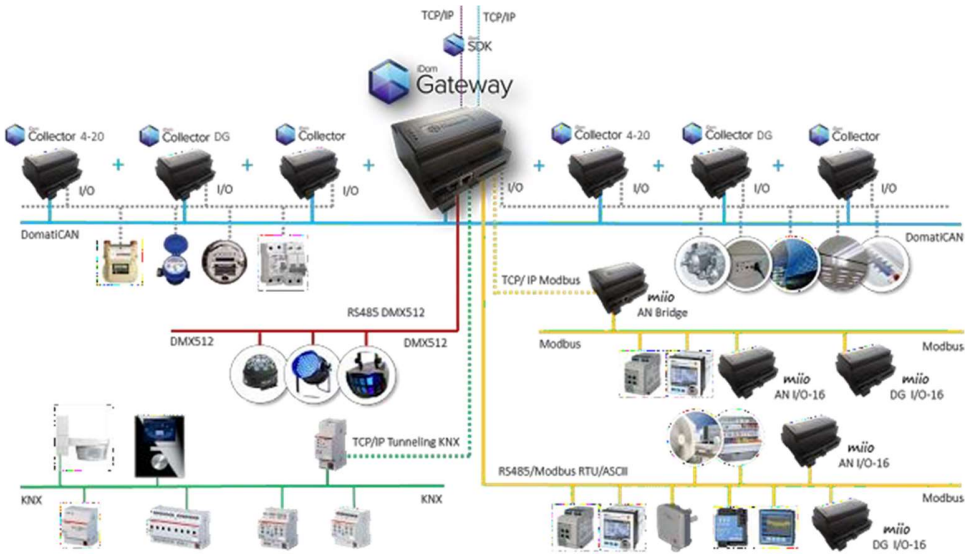
The iDom Gateway is a communications concentrator, acting as a bridge between the measurement/control equipment and the management interface. Additionally, it allows the interaction of communications between different types of protocols. The following figure shows the architecture of this component.



With a distributed intelligence architecture it is possible to add additional input/output modules (iDom Collector) that allow to address almost all the challenges of organizations.

The following figure presents a distributed architecture with a diverse set of needs both in terms of communication protocols and in terms of units of measurement.

Project co-financed by the European Regional Development Fund



The COMPTA GPRS Gateway has the following features and functionality:

- Provision of information in real time;
- Hardware Interoperability
- Dynamic Datapipe
- Cloud Programming
- Distributed intelligence
- Local processing power
- Monitoring and remote control
- Data logging
- Infrastructure flexibility and scalability
- Remote diagnostics and troubleshooting
- Remote firmware updates
- Description Energy Gateway

Project co-financed by the European Regional Development Fund

The programming equipment / analysis and automation of electricity is "GPRS Gateway" type of COMPTA.

This controller registers information in real time, has capacity for a minimum of 150,000 Datalogging records, allows programming via cloud, has distributed intelligence, has local processing capacity and allows remote command and monitoring. This equipment is equipped with remote diagnostic and tracking tools, and allows firmware updates.

The equipment guarantee the following interfaces: Ethernet 10/100 Mbps RJ45 ports; RS 232; RS 485; DomaticaCAN Bus and support the protocols: Modbus; KNX; DMX512. The equipment will have to communicate via GSM, GPRS and Wi-fi.

4.2 - MONITORING SOFTWARE

- OBJECTIVES

The Bee2Energy energy management platform has the following objectives:

- Provide companies/entities with a Decision Support tool;
- Evaluate and manage several locations and equipment simultaneously;
- Validate Use Behaviors and Improvement Activities;
- Verify anomalies (nonconformities);
- Provide companies/entities with a tool with capabilities for action and home automation;
- Validate supply invoices;
- Enhance Cost Center in Income Center.
- Using a simple and segmented approach by type of information, it is possible for any customer to evaluate the information being collected and take actions to increase the energy efficiency of their organizations.

Project co-financed by the European Regional Development Fund

- REGISTRATION

QG - General Board; QP - Partial Board

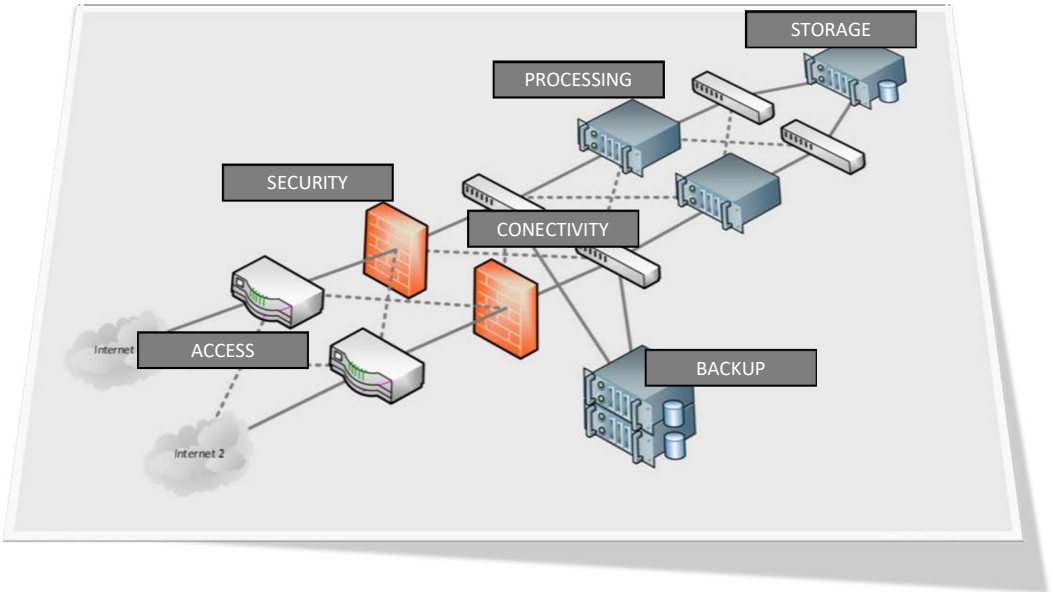
For each physical customer site there may be an energy supply contract. In this way, it is possible to place in the application the registration information associated with the following information:

Locations: Identification of the physical location and its details;

Delivery Points: Identification of the structure of electrical switchboards existing in each physical location.

- SAAS MODEL (SOFTWARE AS A SERVICE)

The following figure presents the system infrastructure approach for the Bee2Energy solution, taking into account the minimisation of points of failure in the infrastructure:



Project co-financed by the European Regional Development Fund

The Bee2Energy solution is available through remote access where users use their credentials to access their profile.

Compta Emerging Business, S.A. interconnect the infrastructure of the Bee2Energy solution with the ENA network to ensure all information confidentiality issues.

4.3 - WALLBOARD

The wallboard is a complement to the management solution and allows to provide a set of information in context that may have several different sources. It is possible to make available to a group of people the presentation of energy information associated with business variables, as well as present multimedia channels, institutional information, etc. It´s a visual template appealing that can serve as an institutional channel for presentation of data of organizations.

Project co-financed by the European Regional Development Fund

5.- CONCLUSSIONS AND FUTURE WORK

The pilot of ESMARTCITY project for smart buildings was successfully deployed at the 29 Public Buildings in Setúbal, Palmela and Sesimbra.

The difficulties found in the development of this pilot deployment and the experience gained will be used as a valuable knowledge for future work.

Some of the lessons learnt that will determine future work are:

Technical challenges:

- Despite the difficulties in the communication network due to technical lack of local sites for transferring data in real time, the pilot is the proof-of-concept for future smart services projects in the territory.

Need for deeper reflection about data property:

- The property and management of the collected data should be more discussed with all stakeholders (limits to public property, business based on the collected data: service-oriented vs applications license-based; etc.)
- The Municipalities involved in the Pilot Deployment through the public buildings provide the collected data for public usage in the framework of this project.

Project co-financed by the European Regional Development Fund

Data as a basis for innovative ideas and solutions

- The pilot is gathering data for smart building to better understand the real needs of public buildings
- The public usage of the data collected should serve as a trigger for many incoming start-ups and innovative ideas
- Opportunity to create add value based in the data: pilot deployment is the starting point for the future development of data analysis models that make these buildings more intelligent through artificial intelligence (AI).
- The implementation of IoT Solutions is feasible, scalable and replicable in the most diverse municipal buildings, other partners and other public entities, in Portugal.
- The pilot contributes to the improvement of the innovation capacity of the Municipalities in its area of intervention, through the creation of an innovation ecosystem that involves companies, research centres, academia and public authorities, creating in this territory the necessary conditions to implement the Smart City concept.

Future

- This project is directly focusing on the challenge of optimizing energy consumption in public buildings, a challenge that will continue growing due to the acceleration of the urbanization process.
- An extension of this Pilot is envisaged as future work, mainly with other public buildings. The Pilot´s platform will enable the users to proceed with complex data analysis tasks, and use the results to take decisions
- This project presents just one of many possible smart services for enhancing the energy efficiency of public buildings. We should work hardly to promote the understanding and awareness of this project and its results with better understanding of all related benefits. So, the project planning, implementation and testing phases should be disseminated to public sector and citizens as much as possible.

Project co-financed by the European Regional Development Fund