EMPOWER Energy monitoring

Guidebook 2022

Good Practices

Energy and Climate Agency of Podravje

energap
Energetsko podnebna agencija za Podravje

EMPOWER
Interreg Europe
European Union
European Regional Development Fund

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1. Introduction

Local communities play a key role in tackling climate changes mainly caused by the inefficient energy use and the use of fossil fuels. EU has a leading role in sustainable energy developments. It has prepared and adopted many climate and energy programmes, strategies, action plans and regulations.

Despite the intensive investment in renovation of buildings in recent years, the building stock still represents the sector with the highest potential for achieving energy savings. There are many new technologies and system that can assure low energy or even zero and plus energy buildings.

Nevertheless, there are still too many cases where planned energy and CO_2 emission savings are not met. The reasons are mainly in bad or no energy management including people (users) behaviour. One of the most important issues is energy management with energy and financial monitoring. Gathering data and evaluation of energy and environmental performances are at the heart of decarbonisation strategies to enhance energy efficiency and to reduce energy use in buildings. The European Energy Performance of Buildings Directive (EPBD) and Directive on Energy Efficiency also require EU members to encourage intelligent metering and active control and management systems in new or renovated buildings. Not having proper data could lead to wrong policy decisions and actions, and, as a consequence, to lost opportunities for savings and even get higher costs. In past years, there was not a lot of energy data related to different users especially in public sector. Without good data planning of energy efficient activities is difficult. Without good monitoring the results are also difficult to check. Therefore, public sector has to start following some private sector models and standards related to energy monitoring and energy planning (like ISO 16001, 50001). EU member states more or less follow the EU strategies and programmes in the field**.**

2. Energy monitoring (EU)

Energy monitoring is continuous recording, analysis and visualization of energy requirements, in private homes, companies and or in public buildings. The current measurement of individual consumers as well as the evaluation and comparison of the measurement data obtained enables a detailed power consumption analysis of your energy behaviour. Individual and efficient savings potential can be derived from these findings, both in watts and in euros. In this way, energy monitoring not only contributes to a reduction in energy consumption and costs, but is also an efficient measure for dealing with our environment in a way that conserves resources. Environmental protection begins with the awareness that our natural resources on Earth are limited. Due to increasing economic and population growth and climate change, the consumption of resources is increasing steadily. And this is always associated with pollution for our environment. The consequences are emissions of pollutants in water, soil and air that permanently damage the ecosystem. It is a fact that the current use of our natural resources significantly exceeds the Earth's ability to regenerate. The only way to use our resources in the long term is to use them carefully. Only then can future generations draw from the wealth of our earth (Source: https://watt-analytics.com/en/sustainability/).

3. Good Practices

The EMPOWER partnership of 9 European regions were working together to share experiences, solutions and good practices to develop and to improve low-carbon economy policies with the identification of energy monitoring, smart technology and behaviour change initiatives.

In May 2022, EMPOWER project partners organized Interreg Europe EMPOWER Peer Review Workshops in Paris, focusing on Energy monitoring.

This guidebook displays 7 of the good practices relating to Energy Monitoring and how they can be implemented at national, regional and local level to help reduce carbon emissions.

3.1. Easy monitoring of energy efficiency in homes with the help of an "Carbon reduction suitcase" – tool kit

ENERGAP has decided to offer to the citizens easy monitoring of their homes with the help of an **"Carbon reduction suitcase" – tool kit**.

People can borrow the suitcase for free from energy advisor. The advisor gives the instructions on the use and help explain the results of the measurements. Tool kit is equipped with equipment to detect conditions of energy losses in homes – electricity meter, infrared camera, luminance meter, liquid thermometer, stopwatch, key for venting radiators and thermometer. The tool kit has supportive paper and electronic learning materials (videos). With the help of the tool kit, citizens are able to identify problems or detect home conditions, implement measures, check and see savings in their house on their own or with the help of an energy expert who comes to their home.

Tool kit will respond to following needs:

- understanding energy use in your home,
- help to reduce carbon footprint impact on the environment,
- economic and environmental benefits to reducing energy use,
- making your house more efficient and reducing your energy consumption and therefore reducing greenhouse gas (GHG) emissions.

After returning the suitcase to Energap, advisor will be able to explain to the citizen in detail the energy situation of his home on the basis of the measured data.

Figure 1: "Carbon reduction suitcase" – tool kit

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3.2. Monitoring of electricity use and PV production to calculate self-sufficiency

The aim of the **pilot project Microgrid** is to establish a pilot microgrid that would serve for modelling and finding solutions for:

- possible self-sufficiency of public buildings and related reduction of energy costs
- possible island operation of the microgrid which would provide energy even in the event of a failure of the public network caused by natural and other disasters
- legal formal establishment of an energy community in which, in addition to the municipality, interested citizens would participate and finance the installation of photovoltaic power plants at the fire station.

The project involves the following public buildings:

- Primary School with a gym
- Kindergarten
- Culture Centre
- municipal building
- Fire station

Further, a photovoltaic power plant and a cogeneration plant (CHP) for the production of electricity and heat are part of the pilot project. Both were installed at the primary school. In the modelling of microgrid system, we found a solution for the monitoring of the consumption and production of electricity at all facilities included in the microgrid. The meters or controllers are built into each measuring point or electric meter.

The monitoring provides insight into real-time electricity data and thus the possibility of reducing energy consumption and costs, the possibility of reducing current loads and peak power. The communication between the controller and the main electricity meter allows us to monitor the following parameters: - total electricity consumption - current power consumption, voltage and current of each phase for all buildings, automatic energy accounting is established for targeted monitoring of energy consumption in the online application of the control system. Electric power measurements are performed at 15 minutes interval on all microgrid buildings.

Based on the measurements, it is established that in the future it will be necessary to increase the share of electricity produced from RES and consequently install more photovoltaics in order to ensure the maximum possible self-sufficiency of the community and to reduce the electricity bill of the end users. With such data also energy or RES communities could be easily established.

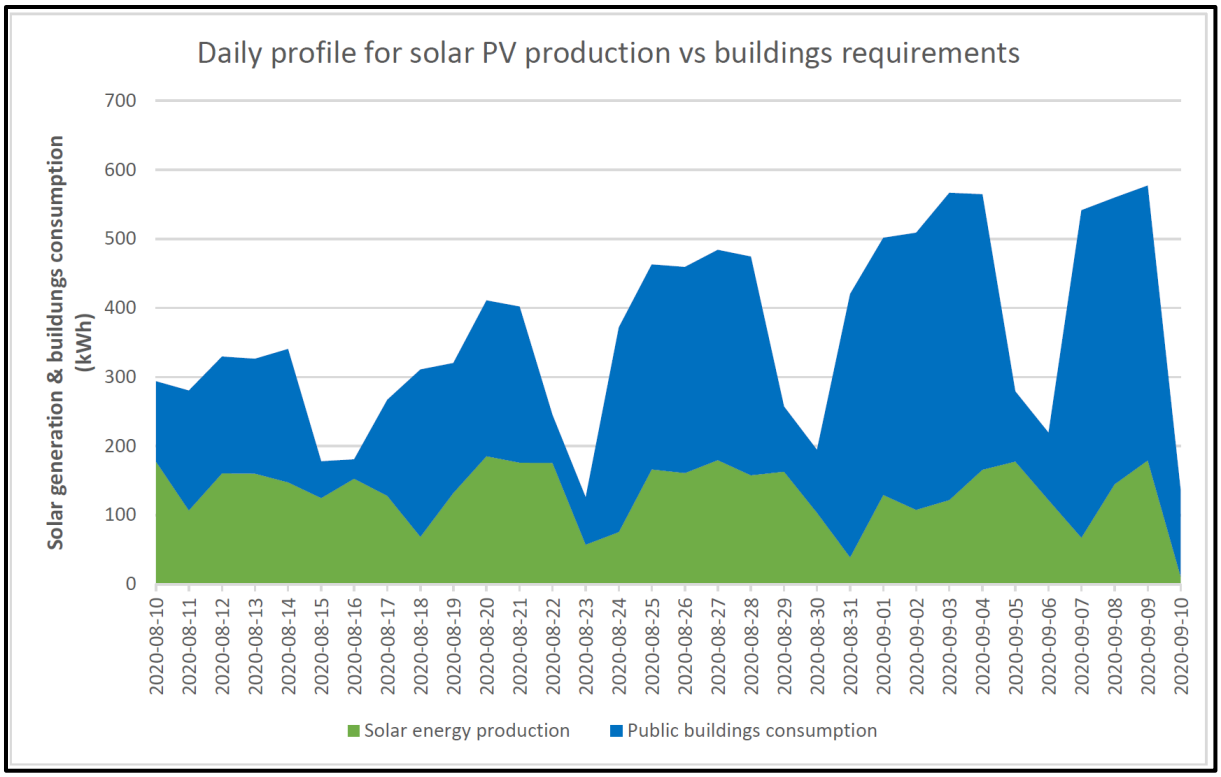

Figure 2: Daily profile for solar PV production vs buildings requirements

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3.3. Energy and Environmental Measuring Monitoring and Reporting system - EEMMR

The **EEMMR** has been installed as part of the Empower regional action plan in the southern region of Ireland. It is measuring the energy consumption – heating, hot water and electricity of each circuit in each apartment. The external environment in each apartment is also being measured. The information stored can be used to determine energy consumption patterns in each apartment which when combined with the energy rating of the house can be used to assist with determining the level of energy poverty to which the tenants are exposed.

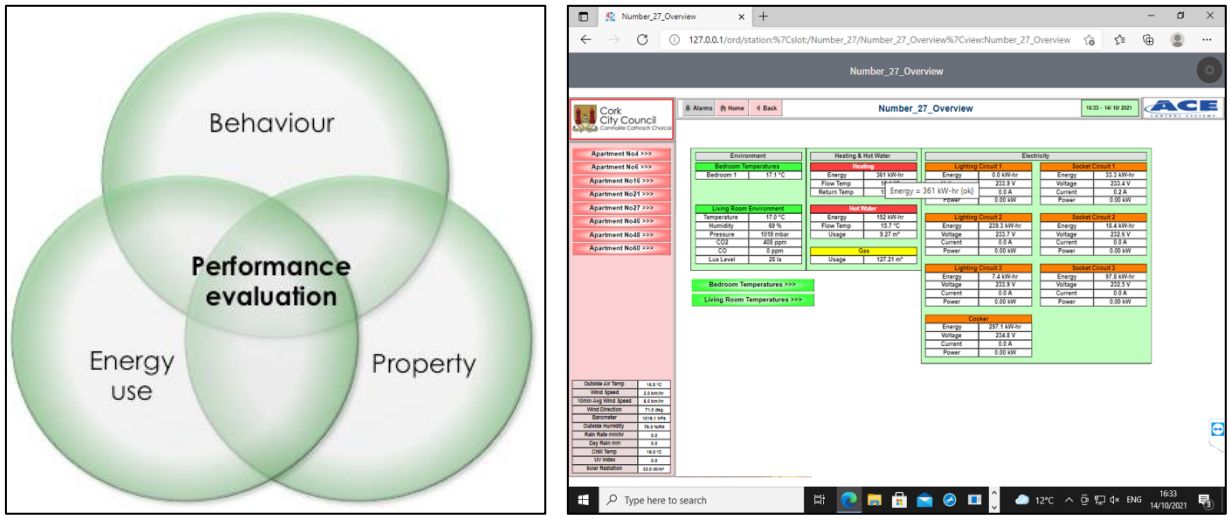

Figure 3: Three components of Performance evaluation and system for monitoring internal environment and external factors

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3.4. The great energy challenge and the teddy energy monitoring

The **"Great Energy Challenge"** is a challenge between teams around energy. These teams, working in a predefined area, are made up of citizens, companies and local authorities. Since 2020, it also includes water consumption by manual reading. The "GEC" animation was developed on an initiative of the ALEC du Pays de Rennes with the support of the SEN project. The software tool is based on the BMHS software.

The city of Rennes has carried out an energy and water challenge. It was tested a small device realized in low tech allowing to alert the inhabitants on their energy consumptions. It is called the **small energy teddy.**

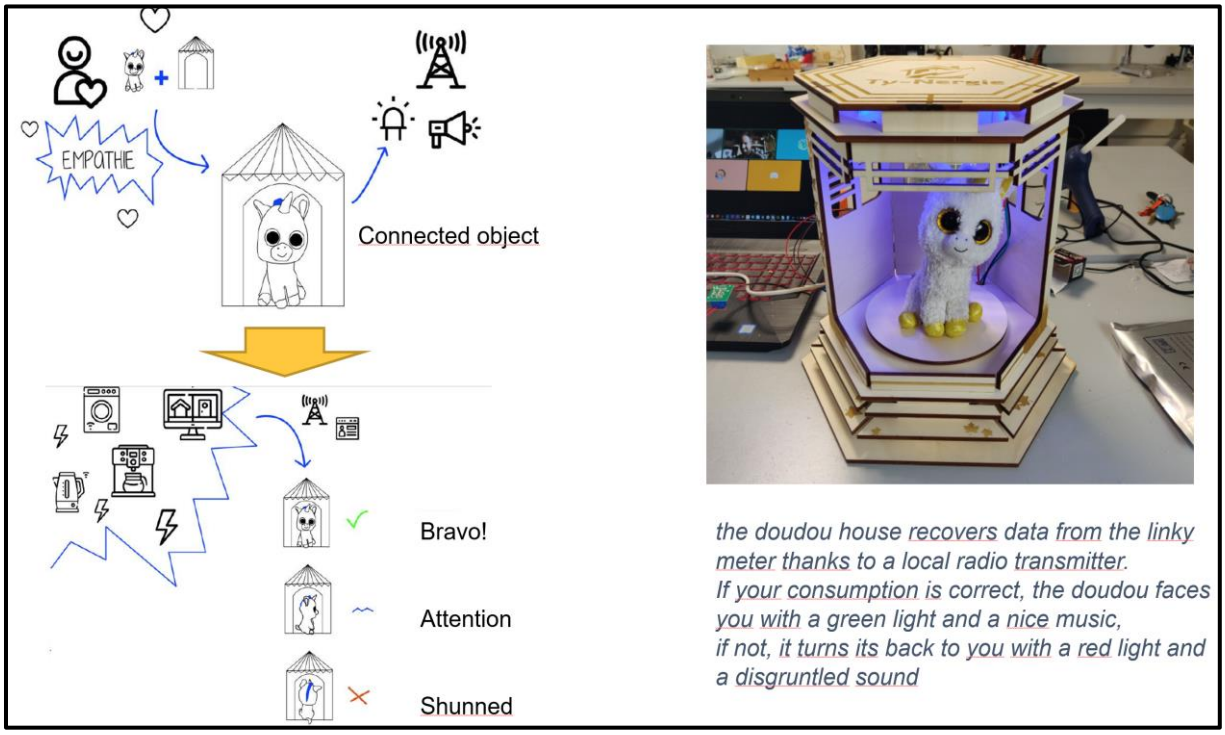

Figure 4: The teddy energy monitoring

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3.5. EnOff by municipalities – for municipalities: A new method for public procurement of energy efficient retrofitting

EnOff is a new method for public procurement of energy efficient retrofitting.

Why a new model?

1. Energy efficiency is essential to meet climate goals
2. The need for maintenance is great in the municipalities
3. A simple and flexible model lowers the threshold to get started

Now method starts with an energy audit, a collaboration agreement sets the boundaries for the project, the profit percentage, price per hour etc., life cycle costs for packages, not single measures and the client can stop or pause the collaboration at any time.

It is one procurement for all buildings – But step by step implementation.

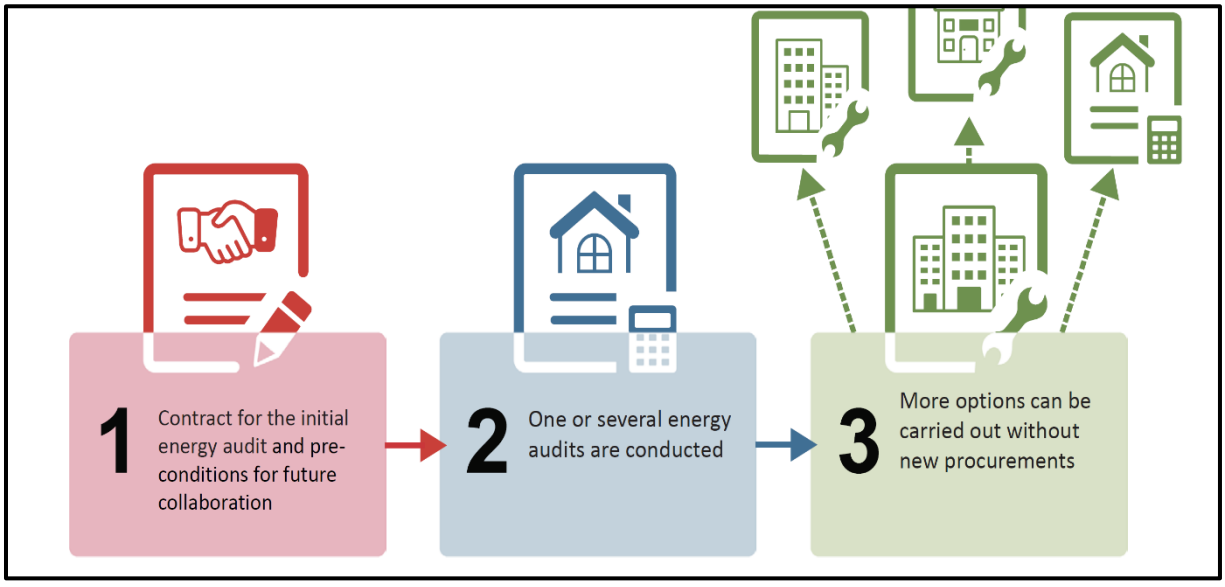

Figure 5: Procurement for all buildings – step by step implementation

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3.6. The implementation of energy measurement system in the "cloud" technology

The energy management system in the 7 locations in Podkowa Leśna is based on Virtual Power Plant that was launched in Wawer District, Warsaw.

However, the idea of TARGET-CE implementation was to extend the system on through energy monitoring in buildings, facilitating their management and allowing to optimize each of the energy source used.

The major challenge was to network the spread infrastructure among forestry area and efficiently communicate energy generation/ usage. Measurements obtained in public buildings located in the city of Podkowa Leśna, i.e., two municipal buildings, City Hall, Social Welfare Center, "Casino" Palace, Center for Civil and Cultural Initiatives and Municipal Public Library will help not only to identify the current shape of the current the energy profile of each building, but they will show how to manage this type of building and how to modernize it in order to achieve savings.

In addition, the recorded data and the presented profile will indicate which times of the day are critical, especially for residents of municipal buildings who use the building full-time. An advantage of the created monitoring is also the discrepancy in energy classes of buildings (which have been assessed on the basis of energy performance certificates), which clearly show the technological and energy advancement as well as the needs in 2 individual buildings.

The most energy-efficient buildings are characterized by the E energy class and require modernization, while the most advanced ones are characterized by the B energy class. In combination with other tools obtained as part of the TARGET-CE project, especially the EPC Living Tool down streamed from eCentral

Project, the City of Podkowa Leśna will be able to almost independently, on the basis of energy certificates and measured energy consumption, identify the thermal modernization possibilities of buildings - from small ones in buildings closer to the low energy standard for thoroughfares in buildings with poor energy performance. The system is being prepared to be connected to CO_2 emission platform the town uses to monitor harmful gases in the atmosphere. The government hopes not only for added values of IT software working together but also to gather wider public attention and the rise of citizens environmental awareness in the future.

The **Ampio Smart Home system** is intended for installation and configuration performed by qualified installers. This is also reflected in the design of the Ampio Cloud. One of the mechanisms of such a system establishment model is the mechanism of installation statuses. This mechanism makes it possible for installers to configure the system remotely during its implementation and, at the same time, provides transparency and grants the owner control over who and when may access his/her installation.

Figure 6: Data Collection

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3.7. Monitoring energy usage and environmental impact in Santander's municipal buildings

In-depth **energy monitoring** is related to the frequency of the available data, being necessary to find a balance between the costs of the increase in frequency and the improvement in monitoring to be achieved. In this sense, electricity bills provide monthly consumption, which enables high-level monitoring by tracking the electricity performance month by month. However, smart meters installed in municipal buildings take measurements every hour. Therefore, having access to these measurements can be of significant value in monitoring their energy performance.

As a result of the collaboration with several local stakeholders, listed below, the municipality has a long-term energy monitoring system not only for electricity consumption but also for CO_2 emissions.

Local stakeholders:

- Viesgo, the electricity distribution company, providing the hourly data from the smart meters.
- UTE Telefónica-NEC, integrating data into the Santander Smart City Platform, where all city data is being stored.
- Municipal managers & technicians, defining a dashboard where visualize energy data in a user-friendly way, which help them in their day-to-day tasks.

This system means a step forward in terms of energy efficiency in municipal buildings, as it facilitates the monitoring of energy parameters, such as consumption and KWh/m^2, and environmental parameters, such as CO_2 emissions and CO_2/m^2, for all municipal buildings, by group of buildings or for each building individually. In addition, benchmarking among buildings which belong to the same group is also available.

Finally, by increasing the frequency data, a deeper and detailed analysis of the energy performance of buildings can be carried out, detecting, among other things, unwanted latent consumption, off-hour consumption, etc., which will contribute to a more sustainable use of municipal buildings.

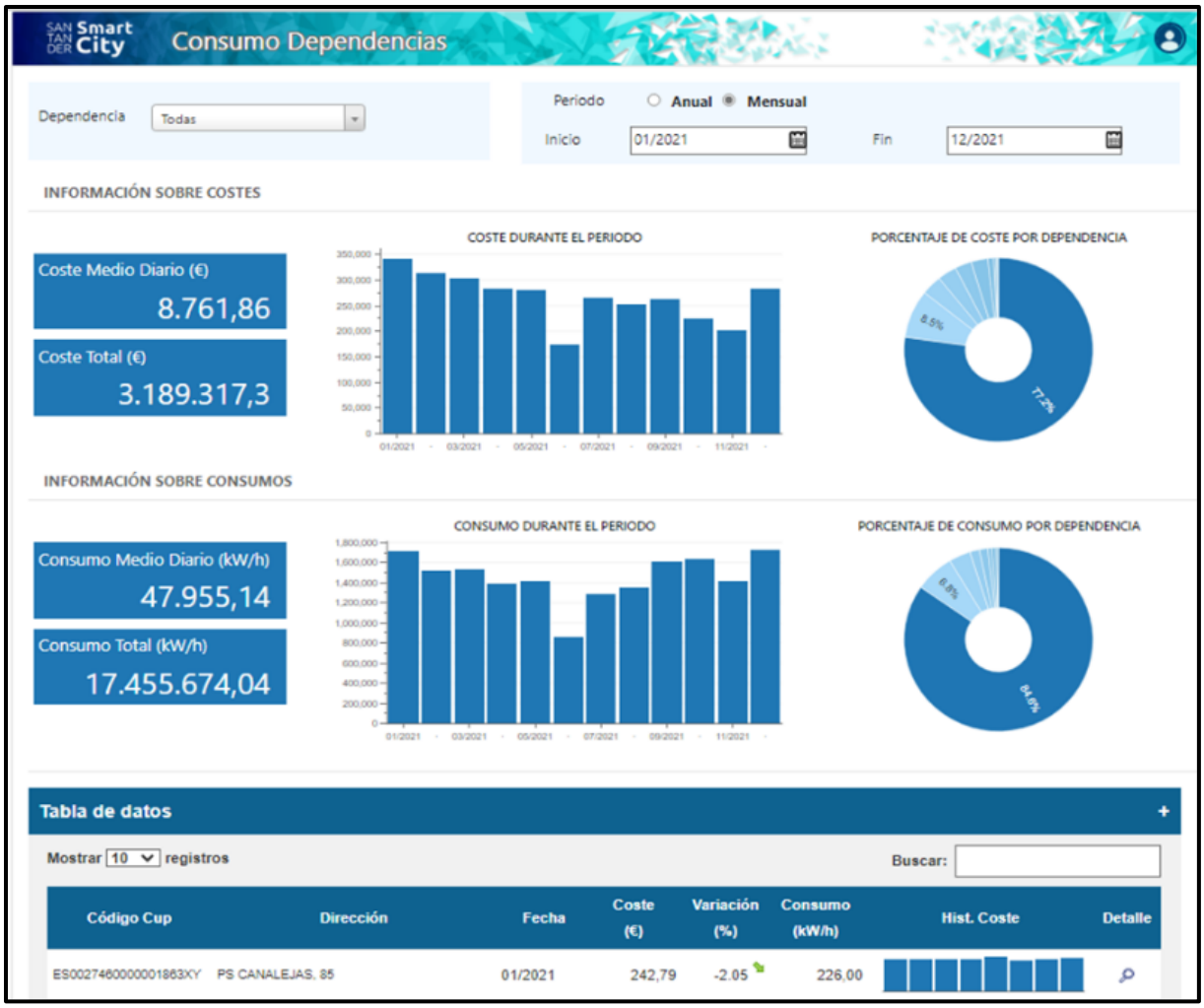

Figure 7: Energy monitoring system

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