Save the Homes

Project duration: 1st September 2020 – 29th February 2024

Grant Agreeent number: 892749 (Coordination and Support Action)

WP: 4. Citizen Hub demonstration: Eindhoven and Valencia

Deliverable: 4.7. Evaluation of the monitored data and the extracted information

Lead beneficiary: IVE

Dissemination Level: Public

Due date: M42

Revision History:

DATE	V	AUTHOR/CONTRIBUTOR	REVISION BY	COMMENTS
22/12/2022	0.1	Ana Sanchís, Eva Lucas, Miriam Navarro	Merle Savelsberg, Haico van Nunen	
17/02/2023	0.2	Merle Savelsberg, Haico van Nunen	Ana Sanchís, Eva Lucas, Miriam Navarro	
26/04/2023	1	Ana Sanchís, Eva Lucas, Miriam Navarro	Merle Savelsberg, Haico van Nunen	
22/12/2023	2	Ana Sanchis, Eva Lucas, Lucía Ramírez, Miriam Navarro	Haico van Nunen, Oubbol Oung	
28/02/2024	3	Ana Sanchis, Eva Lucas, Lucía Ramírez, Miriam Navarro, Haico van Nunen		

1 Executive Summary

This report presents the assessment of the performed monitoring campaigns and the evaluation of the monitored data and extracted information from the two pilots.

The monitoring plan defined in T3.7 has been followed. The relevant data related to building's energy performance and IEQ (well-being of occupants) have been stored, analysed and translated into information relevant for 1) homeowners and 2) local governments and municipalities, thanks to the new generation of holistic user-friendly Energy Performance Certificates (from H2020 U-CERT, TripleA-reno) research.

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2 Introduction

Investments in renovations of homes are vital for the environment, economy, and people's quality of life. Europe is struggling with an aging housing stock where only 10% of buildings currently have A or B class energy performance certificates. Next to that, the condition of a house is increasingly related to health due to demographic and climate change. Living in unrenovated homes can have major implications for your health while improved housing conditions may save lives, reduce health risks and increase quality of lives.

In order to limit the global warming, the carbon dioxide emissions have to be reduced to zero. Buildings are responsible for more than 30% of the global energy consumption, so to reach the near zero-emissions goal, the global emissions from existing housing stock must have been decreased by 80-90% in 2050 compared to the levels of 2010. To achieve this reduction, the renovation rate of the EU existing building stock has to increase. The building stock has a large energy saving potential by i.e. improving thermal insulation, energy efficiency of technical installations. [1]

Thus, by renovating residential buildings, an opportunity presents to achieve major improvements in health, comfort and well-being, and energy savings. However, the renovation process is complicated and unattractive for citizens due to many barriers in the renovation industry, such as the uncertainty of the results and related benefits (and co-benefits) and lack of available and reliable quality checks.

Save the Homes wants to stimulate home renovation demand and increase the home renovation rate in the EU while simultaneously improving people's health, living comfort, and well-being. This will be done by introducing within the Citizen Hub the needed monitoring services and protocols to demonstrate results and co-benefits and build trust in energy renovation processes and results. Therefore, the Citizen Hub will make renovation easier, faster and more affordable by providing Monitoring and verification of work, quality assurance, and independent support.

This Deliverable 4.7. deals with the real implementation of the monitoring data plan in the context of the two pilot ecosystems, defining which specific measurements and measuring protocols (from D3.7.) are effectively applied throughout the different stops of the customer journey to obtain real data about energy, indoor environmental quality, satisfaction, and wellbeing of occupants in the pilot buildings.

The real data obtained in the two pilots will be used to define the KPIs before and after renovation; and the common data management structure will later on allow harmonized data management, handling and sharing (always considering data privacy -GDPR compliance-, addressed in D3.9 Ethics Manual for the two pilots).

[1] IPCC, 'Summary for Urban Policy Makers: What the IPCC special report on global warming of 1.5°C means for cities', 2018

3 Save the Homes Customer Journey

The customer journey describes the experiences, behaviour, and decisions of a customer when interacting with a brand, service or company in the process towards purchasing of goods or services. The full process describes the entire journey. From the very first contact until completing the actions and being an ambassador after. The journey consists of several steps that are walked through from the customers perspective, the exact number of steps depend on the customer journey model, however when comparing different models for a renovation customer journey a general built-up can be seen[2]: For Save the Homes, we translated these steps for renovations as seen in table below:

customer journey model	Save the Homes model
1. Awareness and orientation	1. Onboarding
2. Seeking advice	2. Design
3. Selecting option	3. Elaboration
4. Execution	4. Construction
5. Experience (and inspire)	5. In-use

Table 1.- Customer journey steps

These steps are the base of the customer journey model and follow the decision-making process of the customer. The transition from one step to the next is crucial. The points of interaction between the customer and the company or brand are so-called 'touchpoints. The touchpoints link directly to the experience of the customer in each step of the journey. Each step has its own drivers and barriers which show the reasons for the potential customer to continue or to quit the process.

Each phase of the customer journey intends to ease the renovation process and makes the whole experience user-friendly and appealing, and each has its own goal in terms of monitoring. The figure below represents in visual the key monitoring objectives for each of the customer journey phases:

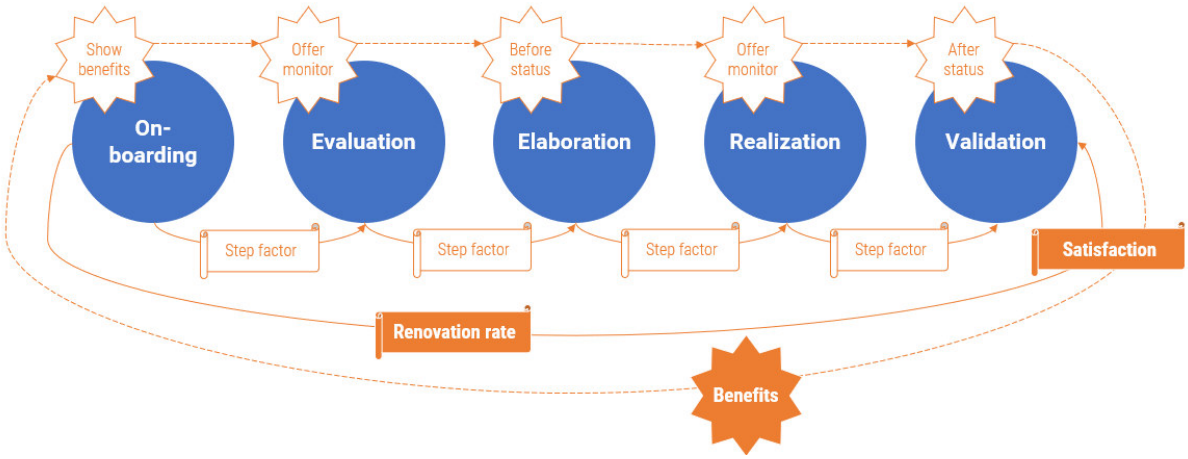


Figure 1.- Key monitoring milestones

The following sections describe the process to effectively implement in each pilot the monitoring protocol from D3.8. The process has three phases: (I) design the monitoring plan, (II) implement the monitoring plan and (III) analyse the results from the collected data. Each pilot implements the monitoring plan from D3.8. on their own way attending to the available resources in each pilot. This document presents the application of the monitoring plan for each pilot in two different sections.

[2] N. Nieboer and A. Straub, 'How do customer journeys regarding energy investments look like?' Conference papers of the European Network for Housing Research (ENHR 2018): More together, more apart: Migration, densification, segregation ENHR, 2018.

4 Valencia Citizen Hub

4.1 Design of the monitoring plan

The following sections show the steps followed to define the monitoring plan in the Valencia pilot:

4.1.1 Definition of the evaluation of the monitoring success.

With the aim of assessing the success of the monitoring of the renovation benefits the following variables are measured in the monitoring process:

Monitoring campaign dissemination	
a	Number of people targeted by newsletters/ social media/ workshops…
b	Number of people who viewed the monitoring campaign
c	Number of clicks on the monitoring campaign
d	Number of dwellings registered in the monitoring campaign
e	Number of dwellings registered for Scenario A.1: Renovated dwellings (after 2020) that want to implement new measures.
f	Number of dwellings registered for Scenario A.2: Renovated dwellings (after 2020) that do not want to implement measures.
g	Number of dwellings registered for Scenario B.1: Non-renovated dwellings (after 2020) that want to implement measures.
h	Number of dwellings registered for Scenario B.2: Non-renovated dwellings (after 2020) that do not want to implement measures.

Monitoring campaign scope	
i	Number of monitored dwellings
j	Monitored dwellings for Scenario A.1.
k	Monitored dwellings for Scenario A.2.
l	Monitored dwellings for Scenario B.1.
m	Monitored dwellings for Scenario B.2.

Monitors' performance	
n	Total number of monitors
o	Number of Hobo monitors (T°C and H%)
p	Number of Trotec BQ30 monitors (Air quality)
q	Number of dwellings monitored with Hobo
r	Number of dwellings monitored with Trotec BQ30

Renovation Stories/Best practices map	
S	Number of dwellings susceptible to appear on the Renovation Stories/Best practices map.
t	Number of dwellings accepting publication on the Renovation Stories/Best practices map.

The above variables are combined to define different indicators that evaluate the success of the monitoring of the renovation benefits. The indicators that will be calculated are shown in the following table:

1. Monitoring campaign dissemination success	
1.1. Views: Number of people who viewed the information about the monitoring campaign	**b/a**
1.2. CTR Click Trough Rate: Number of people who clicked on the monitoring campaign	**c/b**
1.3. Conversion Rate: Number of dwellings registered in the monitoring campaign	**d/c**
1.4. Scenario A.1. registered rate: n of dwellings Sc A.1. registered in the monitoring campaign	**e/d**
1.5. Scenario A.2. registered rate: n of dwellings Sc A.2. registered in the monitoring campaign	**f/d**
1.6. Scenario B.1. registered rate: n of dwellings Sc B.1. registered in the monitoring campaign	**g/d**

1.7. Scenario B.2. registered rate: n of dwellings Sc B.2. registered in the monitoring campaign	**h/d**

2. Monitoring campaign scope	
2.1. Monitoring campaign scope: Number of monitored dwellings	**i/d**
2.2. Scenario A.1. monitored rate: Number of monitored dwellings Sc A.1.	**j/i**
2.3. Scenario A.2. monitored rate: Number of monitored dwellings Sc A.2.	**k/i**
2.4. Scenario B.1. monitored rate: Number of monitored dwellings Sc B.1.	**l/i**
2.5. Scenario B.2. monitored rate: Number of monitored dwellings Sc B.2.	**m/i**

3. Monitors' performance	
3.1. Dwellings with Hobo monitors rate	**q/i**
3.2. Dwellings with Trotec BQ30 monitors rate	**r/i**
3.3. Total monitors' performance	
3.4. Hobo monitors' performance	**q/o**
3.5. Trotec BQ30 monitors' performance	**r/p**

4. Renovation Stories/Best practices map success	
4.1. Renovation stories map rate: monitored dwellings susceptible to be included on the map	**s/i**
4.2. Renovation stories map success rate	**t/s**

4.1.2 Collection of already available renovation stories

Previous experiences help people to feel more identified and better connect with the message. For Valencia pilot, the following renovation stories are available or are being developed . The format of the content will be adapted to audience and communication channel:

- ELIH MED project video **(Available experiences)**. ELIH MED project was focused on energy efficiency in low-income housing in the Mediterranean area. The video shows the experience of the energy renovation of two multi-family buildings told directly by the actors involved in the renovation process: residents, project architects…

Figure 2. Video of ELIH MED project. Testimonies from real cases of energy renovations.

- **Renovation stories/best practices map (Tool under development)**: this map will show geolocated renovation stories based in two sources of data:

- **Auto-map:** renovation cases based on automated data from public sources. In Valencia the existing EPCs are public available. Comparing the pre-renovation and post-renovation EPCs from the same dwelling or building it can be estimated the pre and post energy performance.
- **Pin-map:** when it is available, the map will show a 'pin' with a more defined renovation case based on real information provided by the owner, the tenant, or, for example, the architect in charge of the renovation. When clicking the 'pin', a pop up will appear with the basic renovation data and it can be expanded with information about the building, photographs, its energy performance before and after the renovation, monitoring data and even experiences and testimonies from the occupants. The following figure shows a mock-up of this map and the pop-up of a renovation case. The rest of the pin-map information is provided in Annex 3 – Documents prepared to collect participants for the monitoring campaign.

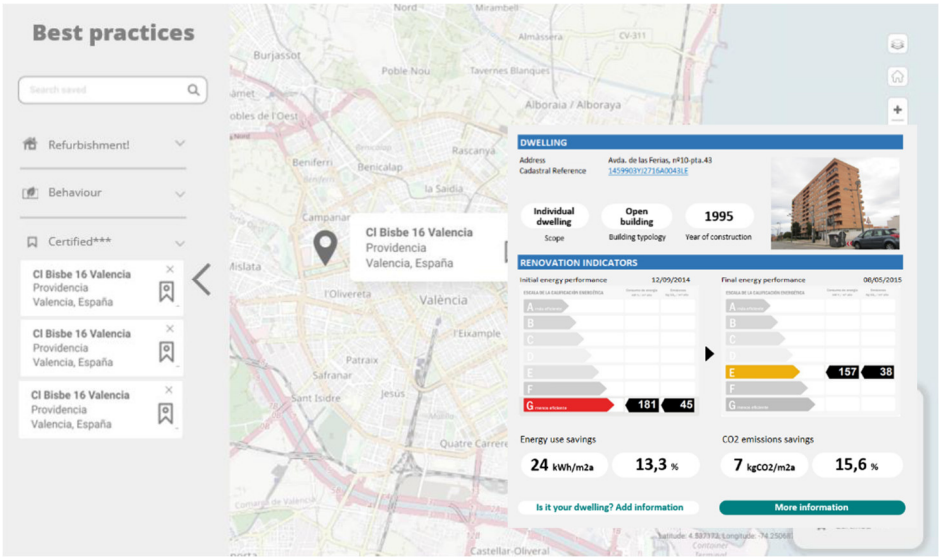


Figure 3.- Renovation stories/Best practices viewer mock-up. View of the renovation case pop-up.

4.1.3 Collection of the energy monitoring cases.

A. Definition of your dissemination documents and channels

With the purpose of offering the monitoring campaign to the largest possible number of participants, several dissemination actions are planned in the Valencia pilot. The dissemination of the monitoring campaign is performed by IVE, VCE and VRCPA and will be developed both on 'in person' events and through online dissemination actions. Newsletters, emails, presentations, and other dissemination formats are prepared with the monitoring campaign information to share them with the widest possible audience with the aim of promoting citizen participation.

To boost the participation in the monitoring campaign, participants will receive one of the following gifts free of charge:

- **Energy performance certification** of the dwelling or the building.
- **Energy efficiency kit.** It contains one 11W and one 6W LED bulb, a timer, a consumption meter and weather stripping for doors and windows.

Figure 4. Energy efficiency kit offered to the monitoring campaign.

The monitoring campaign will be addressed to four different targets, sorted in order of priority, that defines four different scenarios:

- **Scenario A_Post-Monitoring:** People who have already renovated or are renovating their dwellings.

Through the energy consumption gathered from the electric distributor company platforms the pre and post energy performance of the dwelling can be compared. Monitoring the relative humidity and indoor temperature the indoor environmental quality can be observed, and through a questionnaire, the subjective wellbeing can be assessed. Finally, through an interview, their feedback about the renovation process can be gathered. Two subtypes can be found in this scenario:

> A.1. New renovation measures will be implemented.

If new measures are implemented in the following months, a follow up can be done to analyse the usefulness of the customer journey, the services provided by the energy offices and the monitoring campaign. Through the energy consumption from the electric distributor company platforms, a new pre and post renovation energy performance can be made.

> A.2. No new renovation measures will be implemented.

If no new measures are implemented in the following months, the follow up will not be done.

- **Scenario B_ Pre-Monitoring:** People who haven't renovated their dwellings.

Through the energy consumption gathered from the electric distributor company platforms the energy consumption of the dwelling can be analysed. Monitoring the relative humidity and indoor temperature the indoor environmental quality can be observed, and through a questionnaire, the subjective wellbeing can be assessed. Two subtypes can be found in this scenario:

> B.1. Renovation measures will be implemented.

If renovation measures are implemented in the following months, a follow up can be done to analyse the usefulness of the customer journey, the services provided by the energy offices and the monitoring campaign. Through the energy consumption from the electric distributor company platforms, a pre and post renovation energy performance can be made.

> B.2. No renovation measures will be implemented.

If no renovation measures are implemented in the following months, the follow up will not be done.

The channels used to disseminate and recruit volunteers for the monitoring campaign are both physical (when 'in person' touchpoints occur) and virtual:

- Physical proposal:
  - **Personal appointment in the energy office**. When people look for advice about energy saving and rehabilitation, they can be enhanced to participate in the monitoring of the renovation benefits measuring the data before and after the renovation works (scenario 1). When people look for advice about energy bills, right to energy, or renewable energy they can be enhanced to participate in the monitoring campaign although they have already renovated (scenario 2) or are not decided to renovate yet (scenario 3).
  - **Workshops/webinars in the energy office** with people interested in energy bills, right to energy, energy saving and/or rehabilitation and renewable energy.
  - **Citizens' School of Energy Renovation** where people share their experiences and doubts about the renovation process.
- Virtual proposal:
  - **Newsletter for IVE subscribers**, which are mainly technician profiles such as architects and building engineers.
  - **Newsletter for energy office subscribers**, which are people interested in the contents offered by the OSS: energy bills, right to energy, renewable energy and energy saving and rehabilitation.
  - **Email to construction companies** specialized in renovations works registered in IVE's registry.
  - **Email to specialist in renovation management** registered in IVE's registry.
  - **Email to building administrators** through VRCP contacts.
  - **Email to previous attendees** to workshops, webinars, personal appointments, and Citizen's School of Energy Renovation in the energy office.
  - **Social media** sharing the monitoring plan information.

In each stop of the customer journey for the Valencia pilot it is planned to perform actions to involve the occupants in the monitoring of the renovation benefits. The result expected from these actions is the collection of cases studies for the monitoring campaigns and that will feed the Renovation Stories visualization. The following sections show the scenarios covered and how the participation of the citizens in the renovation benefits monitoring is enhanced in each stop.

› **Stop 0 – On-boarding**

Scenarios covered in this stop:

Scenario A_Post-Monitoring: People who have already renovated or are renovating their dwellings.

> A.1. New renovation measures will be implemented.

> A.2. No new renovation measures will be implemented.

Scenario B_ Pre-Monitoring: People who haven't renovated their dwellings.

> B.1. Renovation measures will be implemented.

> B.2. No renovation measures will be implemented.

The objective of the On-boarding stop is to establish contact with the citizen with the aim to create an emotional response and then provide more information to increase interest. To motivate citizens, they are offered with the **Renovation Stories visualization** through websites from Valencia energy office,

IVE, Xaloc and other dissemination channels: ads, RRSS or newsletters. In this regard, the following actions will be done in the Valencia pilot:

a) **Renovation stories maps/catalogue** sharing using the Renovation stories viewer/map, Factsheets and Videos.
b) **Follow-up questionnaire on 'in person' events**. The events where people participate will be leveraged to ask if they have previously seen the renovation stories. In Valencia pilot, the expected 'in person' events are:
    - **Personal appointment**. An expert of the energy office advises citizens about energy bills, right to energy, energy saving and rehabilitation and renewable energy.
    - **Workshop/ webinar**: thematic workshops organized by the energy office with people interested in energy bills, right to energy, energy saving and rehabilitation and renewable energy.
    - **Citizens' school for energy renovation**: where citizens share their experience to be inspiration for other citizens.

On the other hand, **monitoring is offered** to people attending the onboarding actions developed by the energy office in Valencia and to possible interested people from IVE and VCE data bases, although they are not in the customer journey yet. As the public of the actions is very broad, both Scenarios are covered in this phase: people who have renovated (ScA) and people haven't renovated at that moment but are interested in know more about their dwelling's energy performance (ScB). The actions established to offer the monitoring of the renovation benefits in this stop are:

- **Personal appointment in the energy office**. When people look for advice about energy bills, right to energy, or renewable energy they can be enhanced to participate in the monitoring campaign although they are already renovating or have renovated (Sc2) or are not decided to renovate yet (Sc3).
- **Workshop/ webinar in the energy office** with people interested in energy bills, right to energy, energy saving and rehabilitation and renewable energy.
- **Citizens' School of Energy Renovation** where people share their experiences and doubts about the renovation process.
- Newsletter for **IVE and the energy office subscribers**.
- Email to **construction companies** specialized in energy efficiency renovation, **specialist in renovation management**, **building administrators**, **previous attendees** to workshops, webinars, personal appointments, and Citizen's School of Energy Renovation in the energy office.
- **Social media** sharing the monitoring plan information.
- **Brochures** and other signage formats in the energy office.

› **Stop 1 – Evaluation**

Scenarios covered in this stop:

Scenario A_Post-Monitoring: People who have already renovated or are renovating their dwellings.

> A.1. New renovation measures will be implemented.

Scenario B_ Pre-Monitoring: People who haven't renovated their dwellings.

> B.1. Renovation measures will be implemented.

The objective of this stage is to provide information & tools to citizens so they can gain more insights and orientate themselves. Then to get a personal appointment and personalized advice on renovation package to improve the performance of the home in a confidential manner. In this stage, participate

in the **monitoring campaign is also offered** and, since in this step people are willing to renovate their homes, this case covers **Scenario A.1** and **Scenario B.1**

The channels used to offer the monitoring campaign in this stop are:

- **Personal appointments** where the experts of the energy office help citizens to design their renovation: analysis of costs and savings based on **renovEU** and analysis of best subsidies package. People is enhanced to monitor their dwellings and assess its potential based on real data.
- **Citizens' School of Energy Renovation** where people get references and advice from other citizens that have already renovated.

› **Stop 2 – Elaboration**

Scenarios covered in this stop:

Scenario A_Post-Monitoring: People who have already renovated or are renovating their dwellings.

> A.1. New renovation measures will be implemented.

Scenario B_ Pre-Monitoring: People who haven't renovated their dwellings.

> B.1. Renovation measures will be implemented.

The objective of this stage is to organize ideas, solve doubts, decision making and define the final renovation works. In this stop, **Scenario A.1** and **Scenario B.1** is contemplated since people are already decided to renovate their dwellings. This scenario is very interesting since it allows to obtain data from the state before and after the renovation works. Therefore, in this stage **monitoring tools are offered to customers who previously rejected or were not offered.**

The channels used to offer the monitoring campaign in this stop are two:

- **Personal appointments** where the experts of the energy office help citizens organizing financing, renovation packages, decision making and the preparations for the construction of the renovation works.
- **Citizens' School of Energy Renovation** where people get references and advice from other citizens that have already renovated.

› **Stop 3 – Realization**

Scenarios covered in this stop:

Scenario A_Post-Monitoring: People who have already renovated or are renovating their dwellings.

The objective of this stage is to realise renovation according to the plan agreed. In this stop, the **monitoring tools are offered** to people who is in the renovation process (**Scenario A**) to complete the before-status assessment (if the dwelling was previously monitored) or just for an after-status assessment in case the user didn't use the monitoring service before.

The channels used to offer the monitoring campaign in this stop are:

- **Personal appointments** where the experts of the energy office solve doubts during the renovation process and give examples of other renovation works.
- **Citizens' School of Energy Renovation** where people get references and advice from other citizens that have already renovated or are in the renovation process.
- **Follow-up contact** (phone call, mail) after 6-12 months to those who pre-monitored.

› **Stop 4 – Validation**

Scenarios covered in this stop:

Scenario A_Post-Monitoring: People who have already renovated or are renovating their dwellings.

The objective of this stage is to monitor the performance of the dwellings by showing the original dwelling's performance compared to the performance of the improved dwelling. In this stop, **the monitoring tools are offered** to customers who previously rejected or were not offered or customers that monitored the before-status and agree to monitor the before-status as well.

The channels used to offer the monitoring campaign in this stop are:

- **Personal appointments** where the experts of the energy office train occupants to maximise the savings achieved and get feedback and satisfaction from the customers of the whole journey.
- **Citizens' School of Energy Renovation** where people share their experience and advice about the renovation process.

B. Definition of the selection criteria for the monitoring cases

The methodology to select the monitoring cases in the Valencia pilot will be as follows:

a) For each campaign, a call for monitoring cases will be launched using the channels and materials explained above.
b) It will be set a period (one month) for the citizens to show interest in the monitoring campaign. The interested people will sign a registration form showing their interest.
c) Once the registration period is ended, the possible dwellings are listed and analysed. They will be ordered following the following priority criteria:
    1. **Scenario A_Post-Monitoring**: People who are involved in the renovation process or have already renovated.
        > A.1. New renovation measures will be implemented.
        > A.2. No new renovation measures will be implemented.
    2. **Scenario B_ Pre-Monitoring:** People who haven't renovated yet but want to know how their houses perform.
        > B.1. Renovation measures will be implemented.
        > B.2. No renovation measures will be implemented.

Inside each scenario, the criteria to order the monitoring cases will be the distance of the dwelling from Valencia city (location of IVE and energy offices) since several monitoring cases will be set at the same time and monitor dwellings located far from Valencia may not be feasible.

4.1.4 Definition of the monitoring set for data collection

TripleA-reno Monitoring Protocol, adapted to the available monitoring sets, is followed in the definition of the monitoring set for the Valencia pilot. The monitoring will consist of the following measurements and sensors:

a) Indoor environmental Quality (IEQ) measurements

The following table shows the IEQ measurements and sensors that will be used in the Valencia pilot and their characteristics. 15 **HOBO data loggers** and 3 **Trotec BQ30** units are available for the monitoring campaigns. The monitors are small, wireless and they do not consume data.

Figure 5. Left: HOBO data logger. Right: Trotec BQ30

Measurement	Sensor	Units	Mand.	Scale	Type	Units	Period	Range	Accuracy	Resolution
Air Temperature	**HOBO Data Logger**	15	Yes	Indoor + Outdoor	Time series	°C	5 min	-20 to 70	±0,53°C from 0°C to 50°C	0,14°C at 25°C
Relative Humidity			Yes		Time series	%	5 min	25 to 95	±3,5% from 25% to 85%	0,07% at 25°C and 30%RH
CO2	**Trotec BQ30**	3	No	Indoor	Isolated measure	ppm	2/campaign	0 to 9999	±5% /±75 ppm	1 ppm
PM2,5			No		Isolated measure	µg/m³	2/campaign	0 to 2000	-	1 µg/m³
PM10			No		Isolated measure	µg/m³	2/campaign	0 to 2000	-	1 µg/m³

Table 2. Monitors characteristics

The monitoring of the IEQ will consist, at a minimum, of 2 HOBO data loggers per dwelling (one located indoors and one outdoors) since only 3 Trotec BQ30 are available. Therefore, 7 dwellings can be monitored at the same time and 3 of them will count with the CO2, PM2,5 and PM10 measurements from the Trotec BQ30. The Trotec BQ30 monitors will be installed preferably in the **Scenario 1- Pre-Monitoring and Post-Monitoring** cases.

Air temperature and relative humidity will be stored in the data logger and, once the technician has collected the sensors, the data will be analysed. On the other hand, CO2, PM2,5 and PM10 data cannot be stored in the Trotec BQ30 monitor so the methodology will be to write down the data during the installation and uninstalling of the monitoring set by the technician and, in the last visit, ask the occupants if the monitor has shown medium or poor measurements (the colour of the measurement change to orange, red or purple) or if an alarm has sound since the monitor has the option to set an alarm for values of PM 2,5 over 10, 35, 75. 100 or 200 µg/m³. If the occupant agrees, the monitor will be configured with an alarm for PM 2,5 over 75 µg/m³ (medium air quality).

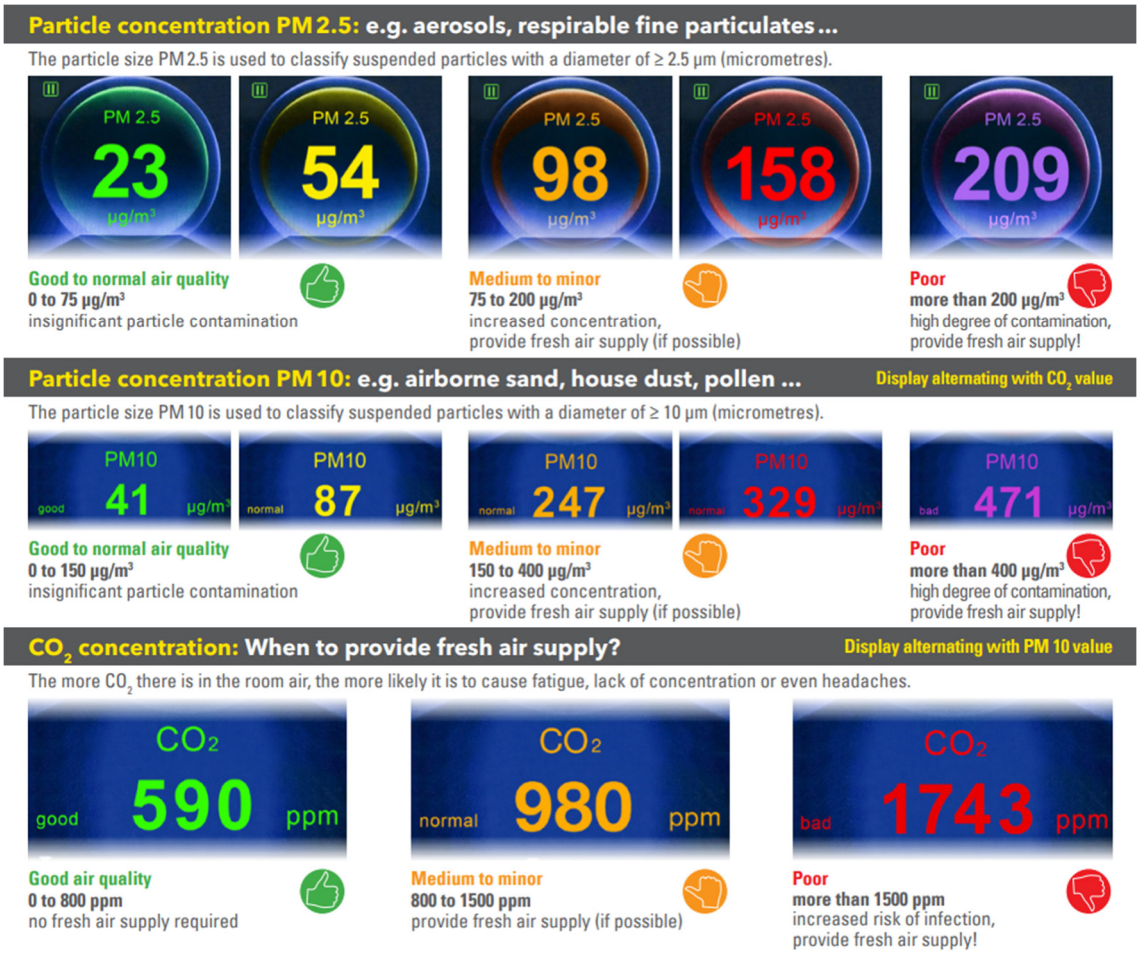


Figure 6. Trotec BQ30 screens for the different variables.

b) Thermographic image

In addition, a thermographic camera will be used to analyse the performance of the façade to observe, for example, the lack of insulation in the walls or the air infiltration from the windows. One thermographic image will be done during the monitoring campaign. Initially, and if the weather conditions allow it, it will be done the day the sensors are installed in the dwelling.

Measurement	Sensor	Units	Mand.	Scale	Type	Units	Period	Range	Accuracy	Resolution
Thermal image	**Flir i7**	1	No	Outdoor	Image	-	1/campaign	-20 to +250 °C	±2°C	140x140

Table 3. Thermographic camera characteristics

c) Energy measurements

For the energy measurements, calculations will derive from energy bills and data accessed through utilities platforms.

In the case of the electricity consumption, the analysis will be done directly using the information from the electric distributor company through the access of the Meter Point Reference Number (MPRN). The energy office in Valencia has already implemented a free online tool that provides a report with recommendations on the changes you can make to your contract to reduce the electricity. This tool asks the user for an authorization to consult the consumption data corresponding to the indicated supply point using the MPRN. In the monitoring campaign, the same data will be requested from the users to obtain the MPRN and get the energy consumption.

The following images show the information that is commonly available in the electric distributor company platforms.

- Graphs with daily, weekly, monthly and for a specific period consumption:

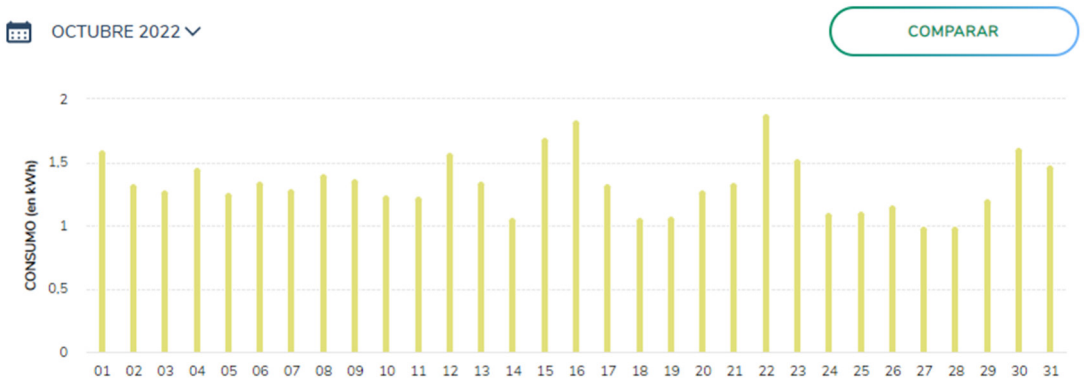


Figure 7. Daily energy consumption

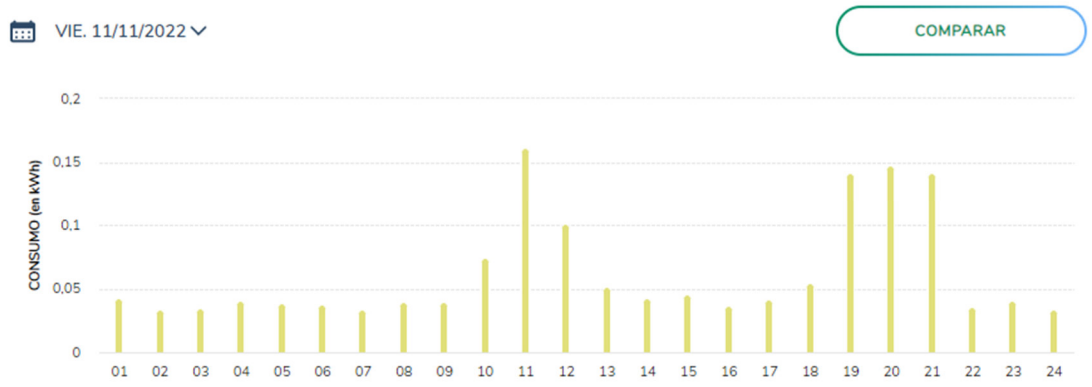


Figure 8. Hourly energy consumption

- Excel/CSV file with the hourly consumption and production.

01/10/2022 - 31/10/2022					
CUPS	**FECHA-HORA**	**INV / VER**	**PERIODO TARIFARIO**	**CONSUMO Wh**	**GENERACION Wh**
ES002100	2022/10/01 01:00	1	Valle	81	0
ES002100	2022/10/01 02:00	1	Valle	77	0
ES002100	2022/10/01 03:00	1	Valle	71	0
ES002100	2022/10/01 04:00	1	Valle	68	0
ES002100	2022/10/01 05:00	1	Valle	65	0
ES002100	2022/10/01 06:00	1	Valle	62	0
ES002100	2022/10/01 07:00	1	Valle	59	0
ES002100	2022/10/01 08:00	1	Valle	54	0
ES002100	2022/10/01 09:00	1	Valle	59	0

Figure 9. Excel file with the hourly energy consumption for a specific period.

In the case of dwellings with heating systems using gas as energy carrier, the consumption will be based on the energy bills provided by the occupants since the smart gas meters are not commonly used and there is not available information from the utilities using the Gas Point Reference Number (GPRN).

d) Health and subjective wellbeing

Health and subjective well-being measurements will be performed through questionnaires which will mainly address the following components:

- Occurrence of health symptoms due to indoor environment
- Indoor environment characteristics - physical stressors
- Type of clothing: to adjust PMV (thermal comfort indicator)
- Activity: sedentary or active? to adjust PMV (thermal comfort indicator)

The questionnaires will be performed twice by the technician that installs the monitoring: one at the beginning of the monitoring campaign and other at the end of the campaign.

4.1.5 Creation of the monitoring campaigns

In the Valencia pilot, it is planned to carry out one monitoring campaign in **winter** (during February 2023). Depending on the number of people interested in participating in the monitoring campaign, the duration of the campaign will be established, with one week being the minimum duration.

If enough participants are available, the maximum monitoring cases, with a one-week campaign, will be 28 dwellings per season (7 one-week monitoring cases at the same time for 4 weeks). However, the number of monitored dwellings will depend as well on the monitors and human resources available to perform the monitoring campaign.

If there are not enough participants to fill the maximum monitoring cases, the monitoring campaign duration could be expanded. For example, if there are 14 possible participants, the campaign will last two weeks instead of one week.

The monitoring campaign will be planned as follows:

Day	Activity
Pre-monitoring	
	Collect automated data
	Calibrate monitors
Week of monitoring	
Day 1	Travel Meeting with the dwelling occupant Supply information and tools to occupants Collect data about the residential unit (for characterization and EC forms) Health and subjective wellbeing questionnaire Renovation Story questionnaire (if applicable) Verify monitoring location Take photogrpahs of the monitoring location Assemble instruments Set-up fixed-site sampling locations Take spotty measurement 1 Start fixed-site continuous monitoring Perform the thermographic analysis
Day 2 to last day	Continue fixed-site continuous monitoring
Last day of the campaign	Collect samples (and ship to laboratory) Take spotty measurement 2 Finish fixed-site continuous monitoring Download data Validate integrity of data Pack equipment Health and subjective wellbeing questionnaire Questionnaire form for data delivery Change to next monitoring case (if applicable)
Post-Monitoring	
	Analyse the collected data Prepare the recommendation report Send or give the recommendation report to the dwelling's occupants

Table 4. Propose activity plan.

4.1.6 Creation of the monitoring registry

As defined in **D3.8. Monitoring plan**, data will be collected under a common schema to easily register the data and build the monitoring labels to include them in the recommendation's reports. The questionnaires and checklists used will follow the same schema to easily transfer the data collected on site to the registry. The monitoring registry is divided in two sections:

- **Building description:** this registry contains the location and characteristics about the building and the dwelling that is going to be monitored. Occupant's profile is also collected in this registry. The information to fill the registry is partially obtained automatically based on the location of the dwelling using the public data (cadastral data), and partially by interviewing the occupants of the building.
- **Monitoring data description**: In this registry the measurements, season, scenario, family of indicators and variables are included.

The monitoring data templates are available in Annex 1 – Benefits Monitoring templatesof this document.

4.1.7 Creation of the questionnaires and checklists

To create the questionnaires and checklist documents, **TripleA-reno monitoring protocol** and the Pin-map questionnaire (provided in **D3.8. Monitoring plan** and in Annex 2 – Best practices map deployment plan) will be taken as a baseline and adapted to Valencia pilot. These documents will have the same variables as the registry to facilitate the transfer of data. The followings documents will be used:

- **Planned activities** (based on TripleA-reno monitoring protocol): this document has all the actions planned to be done in the monitoring campaign of the dwellings and it is used as a checklist to facilitate the technician's work.
- **Building characteristics form** (based on TripleA-reno monitoring protocol): this checklist has two sections: (1) Pre-monitoring section: checklist for the automated data that can be filled before the initial visit and (2) On site visit section: with the data that must be filled with the on-site information of the initial visit.
- **Initial visit checklist** (based on TripleA-reno monitoring protocol): this checklist includes the actions to be carried out in the first visit. Depending on the monitoring scenario (Pre-Monitoring, Post-Monitoring or both), the checklist will automatically adapt to the required information in each case.
- **Health and subjective wellbeing questionnaire** (based on TripleA-reno Labelling Wizard): this questionnaire, performed to the occupants in the initial and final visit of the monitoring campaign, provides the subjective information about the occupant's comfort in the dwelling.
- **Renovation story questionnaire** (based on Pin-map questionnaire): in the case of the Scenario 2 – Post-Monitoring, this questionnaire includes the information about the renovation of the dwelling and contains: implemented measures, economic cost, photographs, energy performance certifications (before and after) and measured energy and/or IEQ data (if available).

The baseline questionnaires and checklists are available in Annex 2 of this document.

4.1.8 Creation of other required documents: consents and forms

During the monitoring campaign, other documents are required. These documents are consents and forms that must be signed by the occupants of the dwellings.

- **Expression of interest form:** This form is shared in the dissemination of the monitoring campaigns. If a citizen is interested in participating in one of the monitoring campaigns, the

first step is to complete this form. Once this person has registered the dwelling, it is considered in the list of possible monitored dwellings. In this form it is asked if the dwellings have been renovated recently and if they will be renovated or further renovated with the aim of categorize each case in one of the four scenarios and sort them in order of priority:

- Have they renovated and are going to implement new measures → Sc A.1.
- Have they renovated and are not going to implement new measures → Sc A.2.
- Haven't they renovated and are going to implement measures → Sc B.1.
- Haven't they renovated and are not going to implement new measures → Sc B.2.

- **Consents forms:** they content the authorization for monitoring the dwelling, for monitoring it after the renovation (if it is the case), for consulting the energy consumption data using MPRN and for incorporating the data in the Renovation Stories map.
- **Factsheet about the monitoring campaign:** A short document with information about the sensors installed in the dwelling and how to use them (in the case of Trotec BQ30).

4.1.9 Creation of the visualizations or outputs

The output of the monitoring campaign consists of a **Recommendations Report** for the occupants of the monitored dwellings. The objective is to provide personalized recommendations based on the monitored data for both reducing the energy consumption and improving the indoor environment quality and the wellbeing of the occupants.

The first part of the report shows the monitored data in an easy and attractive way for the occupants, highlighting the indicators that show the room for improvement and, in the case of the dwellings that have been already renovated (Scenario A.1 and A.2), the energy consumption pre and post the renovation process. The second part shows the recommended measures linked to the previous monitored data.

A list of recommendations has been created based on previous projects and measures that the energy office in Valencia is already providing to the citizens. The recommendations cover measures for reducing the energy consumption of the dwelling and measures to improve the indoor air quality of the occupants. The list of measures is divided as well in three categories depending on the size of the action and one colour is assign to each one to facilitate the differentiation:

- **M1 - Measures without economic cost** – **New habits and free measures**. In this set of measures, it will be included the **Optimization of the electricity tariff**, a free service that the energy office in Valencia is now providing to the citizens. Other measures that will be included in the list are based on measures from previous projects (Elih-Med, TripleA-reno, Drive 0) and measures and recommendations that the energy office in Valencia is providing to the citizens
- **M2 - Measures with a low economic cost** – **Incorporation of small and easy measures**. In this set of recommendations, the measures have a low economic cost but can provide important energy savings for the occupants and the improvement of their wellbeing.
- **M3 - Measures with an economic investment** – **Renovation of the dwelling**. In this set of measures, the results from the **online pre-diagnosis tool renovEU** will be included as the options for the energy renovation of the dwelling.

Depending on the scenario a different set of measures is provided to the dwelling's occupants:

Scenario A_Post-Monitoring: People who have already renovated or are renovating their dwellings.

> **A.1.** New renovation measures will be implemented: **M1** + **M2** + **M3**

People in this scenario want to implement new renovation measures, therefore the three sets of measures are useful for them: new free habits, small interventions, and options of renovations to decide which one fits better suits them.

> **A.2.** No new renovation measures will be implemented: **M1** + **M2**

People in this scenario already renovated their dwellings, therefore, they will be interested in how to introduce new habits or small and easy measures that complement the renovation to reduce the energy bills and improve their comfort.

Scenario B_ Pre-Monitoring: People who haven't renovated their dwellings.

> **B.1.** Renovation measures will be implemented: **M1** + **M2** + **M3**

People in this scenario want to renovate, therefore the three sets of measures are useful for them: new free habits, small interventions, and options of renovations to decide which one fits better suits them.

> **B.2.** No renovation measures will be implemented: **M1** + **M2** + **M3**

People in this scenario are not decided to renovate but want to know how their dwelling performs. Although they don't want to renovate, they have interest in reducing their bills and improve their wellbeing, so this report is a good opportunity to show them the whole picture: free habits to implement at home and easy and cheap measures but also the renovation options with their costs and the possible grants.

As mentioned above, the interest of this report is to provide **personalized measures and recommendations depending on the results of the monitoring campaign**. For this reason, the measures from the list are linked to the possible results of the monitoring campaign and will be shown only if the indicator is activated. For example, if the occupant does not feel any symptom related to poor indoor air quality (fatigue, headache...), the measures listed to improve these symptoms are not provided to the occupant. The objective is to create an "automated" list of measures connected to the monitoring registry and the monitoring campaign data that directly provides the list of personalized recommendations.

The format of the report will be adapted to the reader keeping it as simple as possible to avoid overwhelm the dwelling's occupant. With this purpose, the recommendations will have two levels of information. In the report it will be indicated a brief explanation of the measured and it will also contain direct links to other documents to expand this information if the reader is interested in knowing more about it. The report will be provided to the monitored dwellings occupant physically or via email based on their choice.

The **Recommendation Report** is divided in 4 pages:

1. **Page 1 - Monitored data:** The first page summarizes the data monitored and collected in the dwelling. The first part shows the data from the dwelling and the thermographic image. The rest of the page is divided in four sections showing the different monitored variables:
    - **Energy consumption**: in this section it will be highlighted how far the consumption is from the optimum consumption (based on renovEU data) and, in the case of the dwellings that have been already renovated (Scenario A.1 and A.2), the energy consumption pre and post the renovation process.
    - **Indoor conditions (temperature and relative humidity)**: in this section it will be highlighted the percentage of the time that the dwelling was in a discomfort situation.
    - **Health and wellbeing**: in this section the data about the symptoms, indoor thermal feeling and the data displayed by the Trotec BQ30 and/or collected from the questionnaire and the occupants' interview is shown.
    - **Energy Performance Certificate**: in this part the energy label, if it is available, is shown, and it is highlighted the percentage of dwellings with certificate that has a better energy rating.

The following image shows a mock-up of the first page of the recommendations report with the monitored data:

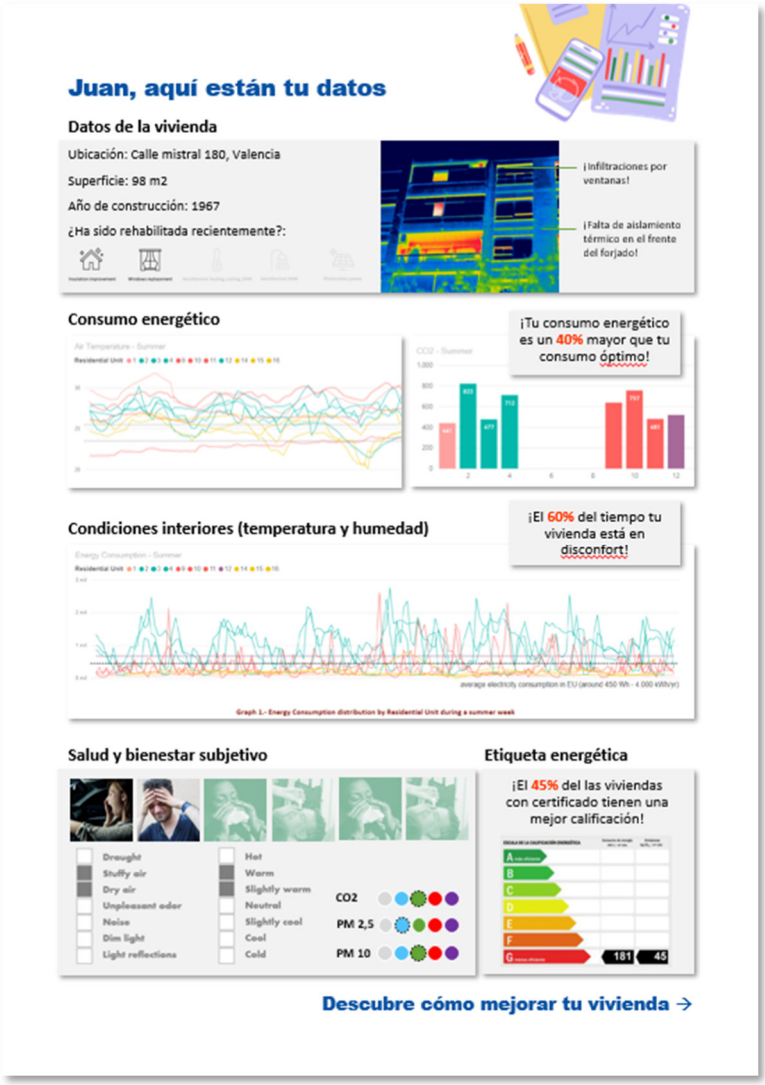


Figure 10. Draft of the first part of the Recommendation report. Monitored data.

2. **Page 2 - Measures without economic cost.** On both sides of one page, the list of habits and free measures that respond to the monitored data of the dwelling are shown. To easily identify this type of measures, the pages are designed using the colour for this type of measures: green. One side of the page shows the measures for saving energy and the other side shows the recommendations that help to improve the health and wellbeing of the dwelling. The information includes the **Optimization of the electricity tariff** as one of the measures and the complete report is also provided physically and by QR code (Annex 4 shows an example of this report). The following image shows a mock-up of the recommended habits and free measures:

Figure 11. Draft of the second part of the Recommendation report. Measures without economic cost. Left: measures to save energy. Right: measures to improve indoor comfort.

3. **Page 3 - Measures with a low economic cost.** Following the same schema as in the previous one, one sheet is used to show the low-cost measures: one side of the page shows low-cost measures to save energy and the other side shows low costs measures to improve the indoor comfort of the occupants. The following image shows a mock-up of the recommended habits and free measures:

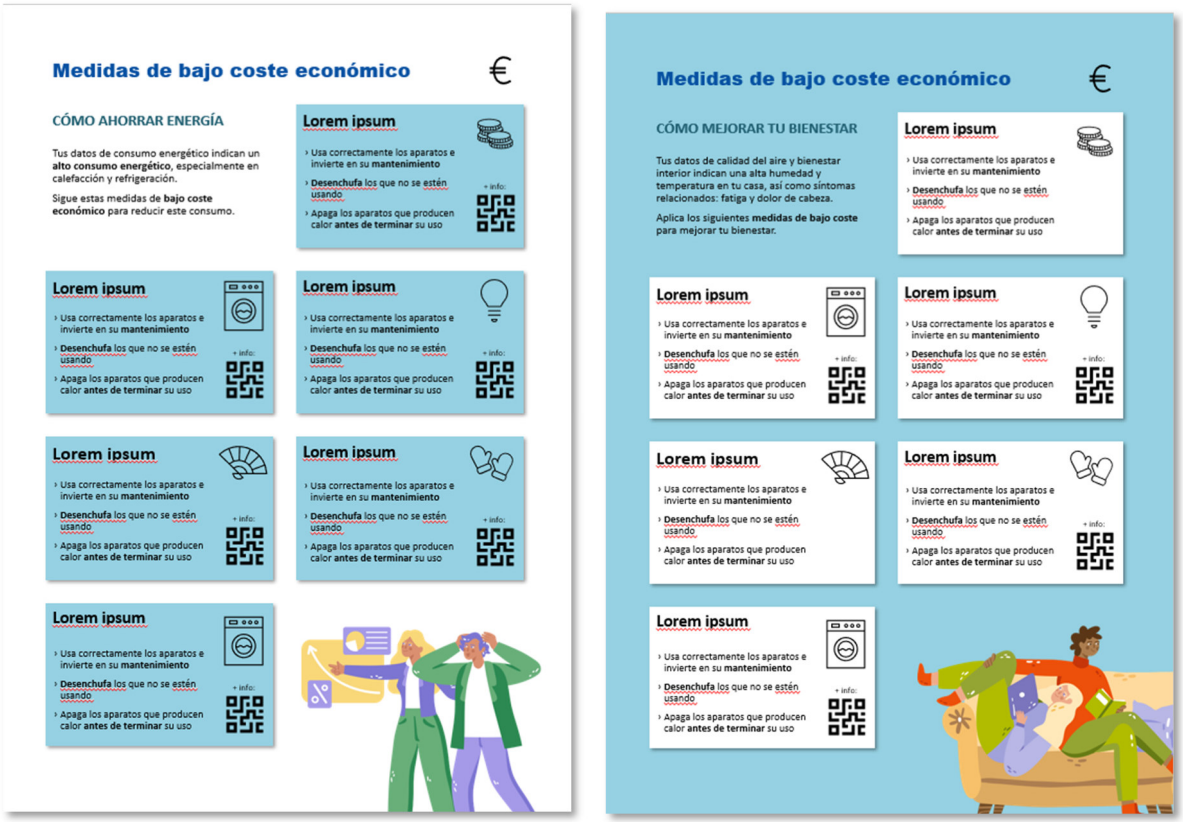


Figure 12. Third part of the Recommendation report. Measures with a low economic cost. Left: measures to save energy. Right: measures to improve indoor comfort.

4. **Page 4 - Measures with an economic investment.** This page shows the renovation options for the monitored dwelling. The information is obtained from the online diagnosis tool developed during the project **RenovEU**. This tool provides different combination of measures. The measures that are considered are:
    - **Windows:** windows renovation
    - **Insulation:** thermal insulation installation in façade and roof.
    - **Aerothermal:** systems renovations using an aerothermal heat pump for heating, cooling and produce DHW
    - **Aerothermal for DHW:** aerothermal heat pump only used to produce domestic hot water.
    - **Photovoltaic:** installation of photovoltaic panels to produce electricity for self-consumption.

    The information is provided on both sides of the page. The first side of the page is divided in three sections:
    1. Estimation of the energy performance of the current state of the dwelling.
    2. Graph with the different renovation options showing the energy savings, comfort improvement, economic cost per dwelling and cost considering the available grants.
    3. Explanation of the **Deep renovation** option (windows + insulation + aerothermal). It is shown the CO2 emissions, percentage of time out of comfort, the energy consumption for the pre and post renovation status, and the cost per dwelling with and without grants. A brief explanation of the measures is shown and QR codes link to the complete report, the budget, the grants information, and the energy offices.

    The other side of the page presents eight more options of renovation showing the comparison between the pre and post renovation state for the CO2 emissions and the energy

consumption. It is also presented the cost of the measures with and without grants. The seven sets of renovation measures presented are:

1. **Intervention on the envelope**: windows + insulation
2. **Systems renovation**: aerothermal
3. **Windows renovation + hot water**: windows + aerothermal DHW
4. **Photovoltaic installation**: photovoltaic
5. **Intervention on the envelope + photovoltaic installation**: windows + insulation + photovoltaic.
6. **Systems renovation + photovoltaic installation**: aerothermal + photovoltaic
7. **Windows + hot water + photovoltaic installation:** windows + aerothermal DHW + photovoltaic
8. **Deep renovation + Photovoltaic**: windows + insulation + aerothermal + photovoltaic

In each renovation option, a QR code is included that links to the RenovEU preliminary report, and the detailed budget of each renovation measures set. In Annex 5 – Example of renovEU preliminary report for a Deep renovation and its budget.an example of the report for the **Deep renovation** option and the detailed budget is presented.

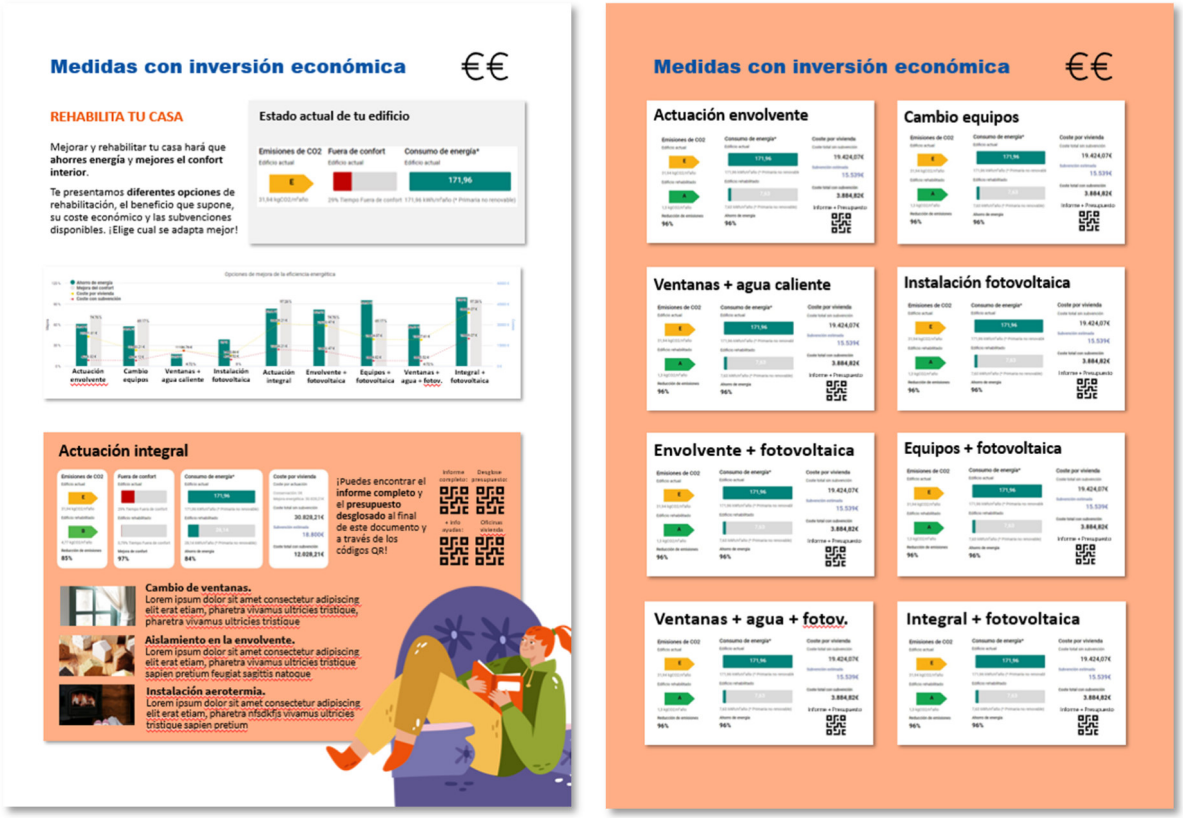


Figure 13. Draft of the fourth part of the Recommendation report. Measures with an economic investment. Left: Current state. Right: measures to improve indoor comfort.

4.2 Implementation of the monitoring campaigns

This section presents the information and reports about de field activities performed during the monitoring campaign developed in the winter season in Valencia. It is explained the whole process to select the monitoring cases, the monitored parameters, and the documents prepared.

4.2.1 Collection of the energy monitoring cases.

This section presents how the monitoring cases were chosen and the documentation prepared.

To boost the participation in the monitoring campaign, and as it was explained in the dissemination of the campaign, participants were rewarded with a gift. They could choose between two options:

- **Energy performance certification** of the dwelling.
- **Energy efficiency kit.** It contains one 11W and one 6W LED bulb, a timer, a consumption meter and weather stripping for doors and windows.

The monitoring campaign addressed 4 different case studies targets:

Scenario A_Post-Monitoring: People who have already renovated or are renovating their dwellings.

> **A.1.** New renovation measures will be implemented.

> **A.2.** No new renovation measures will be implemented.

Scenario B_ Pre-Monitoring: People who haven't renovated their dwellings.

> **B.1.** Renovation measures will be implemented.

> **B.2.** No renovation measures will be implemented.

The dissemination of the monitoring campaign started on the 21st of December 2022 and participants could register their homes until 20th of January 2023.

A. Dissemination documents and channels

The collection of the monitoring cases started preparing the dissemination documents and distributing them through the different available channels. The campaign was called "¡*Conoce y mejora tu casa*!" ("Know and improve your home!"),

- **Website**

A web page located on IVE's website was created with the monitoring campaign explanation: https://www.five.es/campana-gratuita-conoce-y-mejora-tu-casa/. This web site contained the link to the free registration.

Figure 14. Website of the monitoring campaign.

- **Registration form**

In this form, participants were asked to provide basic information in order to characterize each case:

- Contact details
- Location of the dwelling
- Have you made any improvements to your home?
- When were the measures implemented?
- Will you make improvements?
- When will you make them?

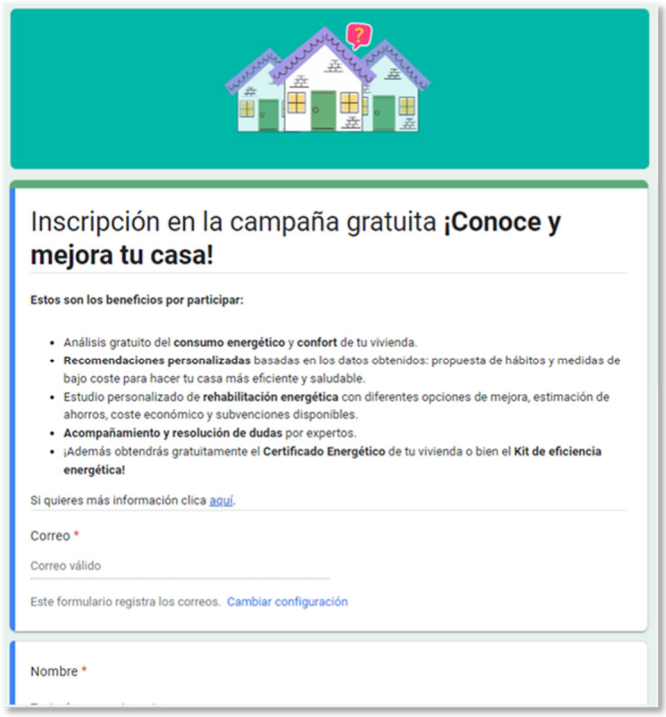


Figure 15. Part of the form prepared for the registration in the monitoring campaign.

- **Presentation**

Presentation prepared to be shared with the participants of the energy office's activities.

Figure 16. Cover of the presentation about the monitoring campaign.

In Annex 3 – Documents prepared to collect participants for the monitoring campaign.it is shown more details about the documents prepared.

- **Channels used for the dissemination.**

The dissemination of the monitoring campaign was done virtually and physically:

  - Newsletter – IVE
  - Social media – VCE and VRCP
  - Personal appointments – VCE
  - Workshops/ Citizens' School of Energy Renovation – VCE

Figure 17. Channels used for the dissemination of the monitoring campaign.

The result of the dissemination of the monitoring campaign was that **252** participants registered their dwellings in the registration form.

Figure 18. Result of the dissemination of the monitoring campaign.

B. Definition of the monitoring campaign – based on registration and resources.

Once the registration period ended and the number of possible cases studies was known, and considering the available resources, the monitoring campaign details could be established.

Regarding the resources, finally 13 temperature and relative humidity sensors were available to be used. On the other hand, the staff available for this task was 1,5 people one month (one person the whole monitoring campaign and one persona half of the monitoring campaign).

Other consideration for the definition of the monitoring campaign was its duration. Since it was a winter campaign, it had to ended before spring started. The campaign was established from 13th of February to 13th of March 2023.

With all these factors and considering that enough possible case studies were registered, the result was that **21 dwelling** could be monitored for **7 days**. A first monitoring calendar was prepared:

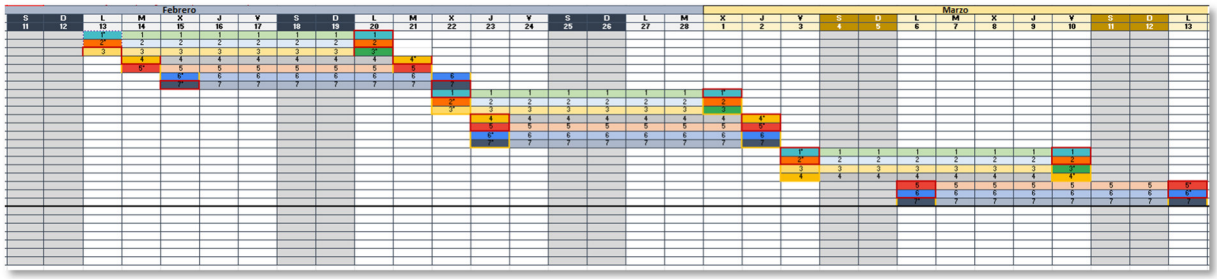


Figure 19. First calendar to define and organize the monitoring campaign.

C. Selection of the monitoring cases

The result of the dissemination campaign was that 252 houses were registered for the monitoring campaign, but only 21 could be selected for this campaign. Therefore, a three steps process of filtering the possible cases was performed.

- **First step – from 252 to 75 dwellings**

The first filter was the proximity to Valencia, and it was established that the houses had to be less than 30 minutes away by car. Using this filter, the cases are reduced to 108.

The second filter in this step was to select the cases that belong to one of the 4 scenarios proposed:

Scenario A. Renovated dwellings (from 2020)
- A.1. Renovated dwellings that want to add new measures.
- A.2. Renovated dwellings that don't want to add new measures.

Scenario B. Not renovated dwellings.
- B.1. Not renovated dwellings that want to add new measures.
- B.2. Not renovated dwellings than don't want to add new measures.

For example, houses that were renovated before 2020 were not selected since the purpose was to compare the energy performance before and after the renovation and the energy consumption could be obtained only since 2018.

Using this second filter, the cases are reduced from 108 to 75 cases divided as follows:

A.1. → 13 units
A.2. → 9 units
B.1. → 41 units
B.2. → 12 units

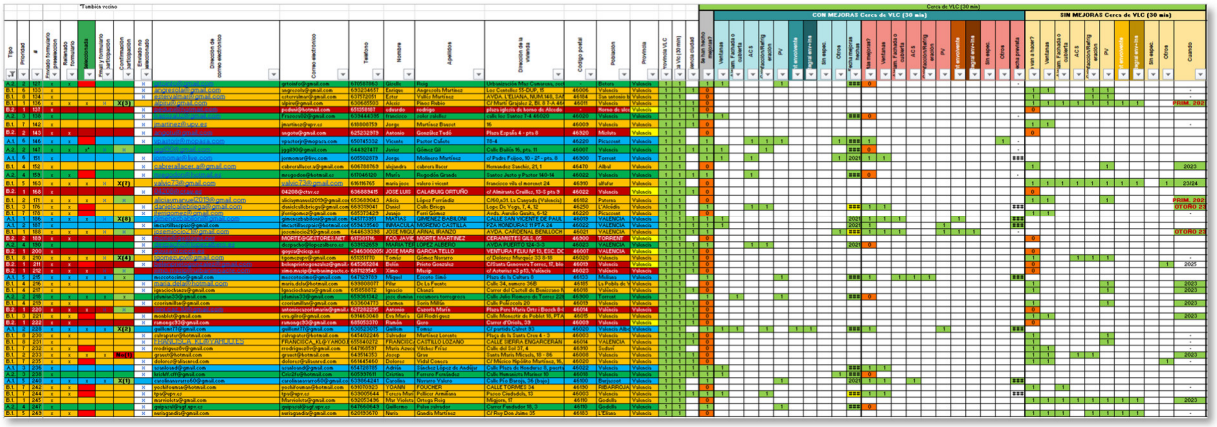


Figure 20. Analysis of the cases and categorization in the four scenarios.

- **Second step - from 75 to 21 dwellings**

New filters were required to reduce the number of cases. A second form was sent to the 75 pre-selected houses. In this new form it was asked if a neighbour with a different scenario could be interested in monitoring campaign as well. The purpose was to compare easily renovated vs not renovated similar houses. A detailed calendar of the 21 cases was defined and this form also asked if they were available in the defined dates for the sensor's installation and collection.

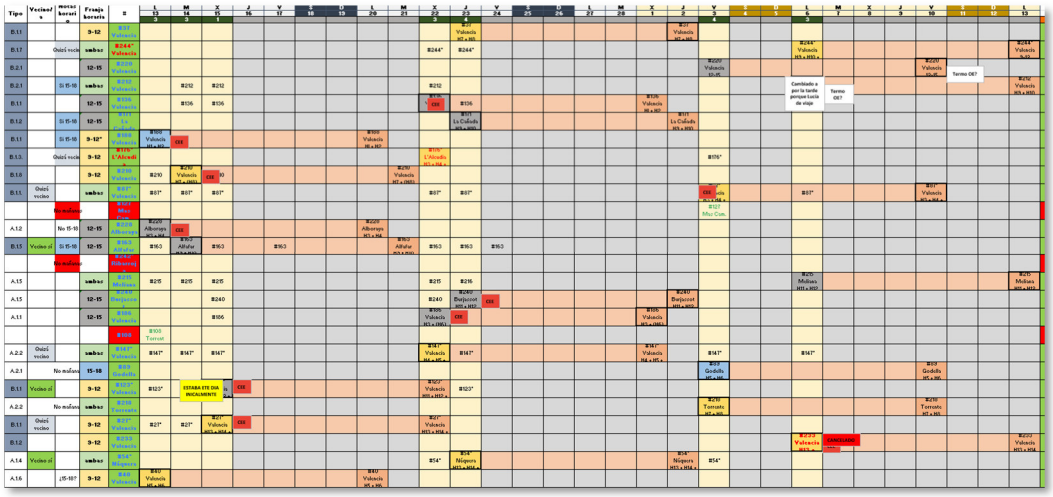


Figure 21. Detailed calendar of the monitoring campaign

The result was that 51 of the 75 pre-selected houses filled out the form. Among these 51 cases, 21 were selected considering their availability for the defined dates, the presence of possible interested neighbours and trying to have representation of all the possible cases and scenarios.

A.1. → 6 units
A.2. → 3 units
B.1. → 10 units
B.2. → 2 units

- **Third step - from 21 to 23 dwellings**

Once the 21 cases were selected, they were notified, and a third form was sent in order to:

- Confirm the participation in the monitoring campaign.
- Confirm the compliance with the date for the installation and collection of the sensors.

- Confirm the participation of the neighbours.
- Provide other relevant data such us if they have the gas bills since 2018, an energy performance certificate or previous measurements (CO2, temperature, relative humidity…)

The result was that 1 dwelling was cancelled by the owner and 3 dwellings from the neighbours were confirmed. The final number of dwellings were 23, divided as follows:

A.1. → 6 units
A.2. → 5 units
B.1. → 9 units
B.2. → 3 units

The following map shows the location of the selected dwellings:

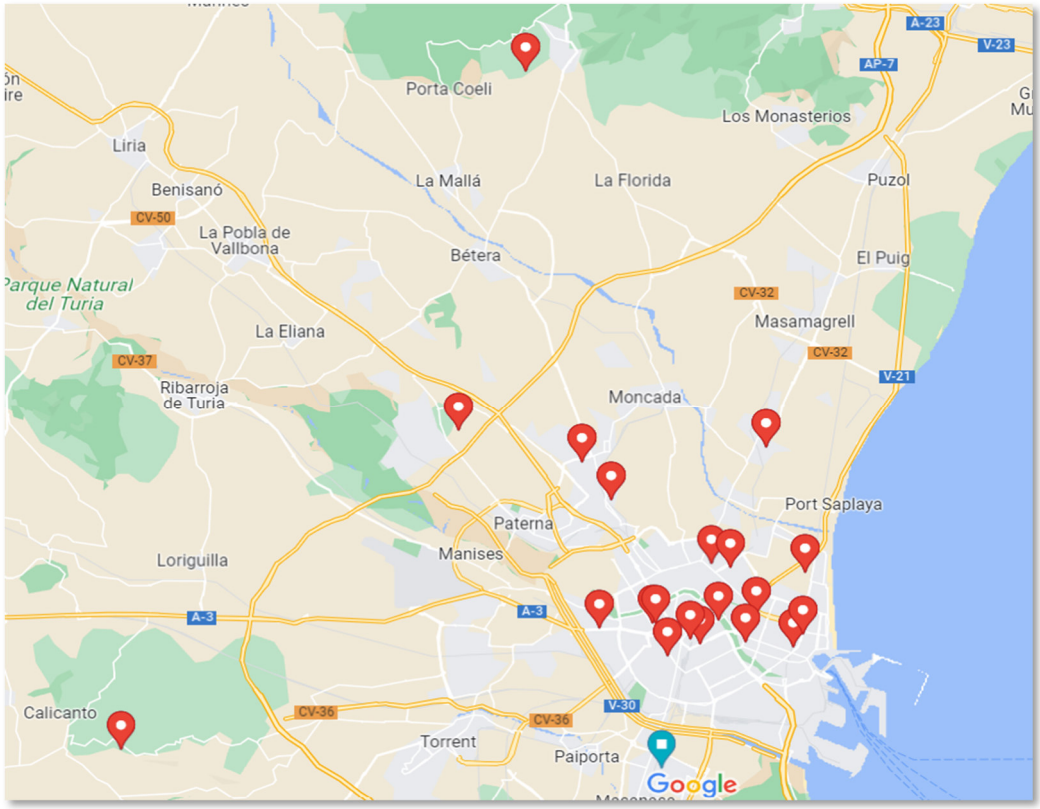


Figure 22. Location of the selected dwellings for the monitoring campaign.

4.2.2 Monitoring set for data collection

Once the list 23 dwellings were selected, the monitoring set for the data collection was prepared. The set consisted of indoor environmental quality measurements, a thermographic study, energy consumption measurements and healthy and subjective wellbeing questionnaires.

A. Indoor Environmental Quality (IEQ) measurements

This section shows the sensors used in the monitoring campaign for the IEQ measurements:

- **Hobo data loggers**

HOBO data loggers were used for the register of the temperature and the relative humidity. Finally, 13 data loggers were available, and they were installed as follows to cover all the cases:

› Dwellings outside Valencia city: 2 Hobos installed (one inside, one outside) → 7 dwellings.
› Dwellings in Valencia city: 1 Hobo installed inside each house → 16 dwellings.
1 Hobo installed outside IVE's office.

The criteria was that the outdoor data for the cases located in the city of Valencia was collected by a common sensor installed in the courtyard of the IVE's office. However, in the dwellings located outside Valencia city, one Hobo was installed outside in each case since there could be important differences in the data with respect to Valencia city.

- **Trotec BQ30**

This monitor shows (but not register) levels of CO2 concentration, particle concentration PM 10 and PM 2.5, humidity and temperature. Three units of this monitor were available, and they could be installed in 7 of the dwellings.

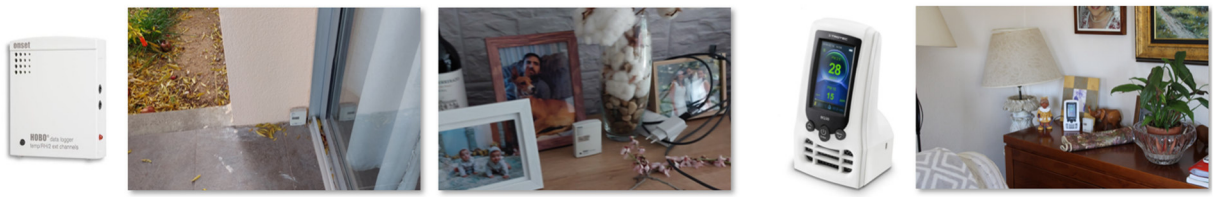


Figure 23. Pictures of the installation of the monitors.

B. Thermographic study

A thermographic study was performed in all the cases. Several thermographic photos were taken inside and outside the dwellings. People were asked to switch on heating 2 hour before the visit with the aim of having the greatest possible thermal contrast between the interior and exterior of the house.

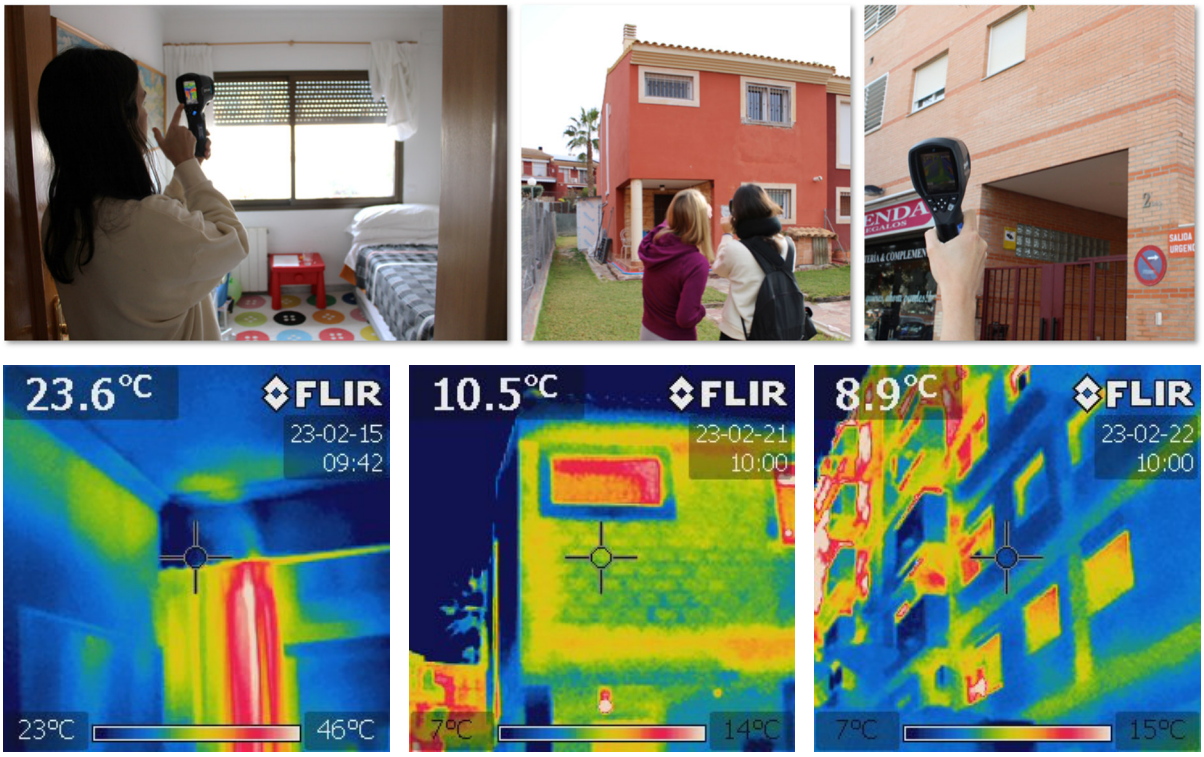


Figure 24. Pictures of the thermographic studies performed inside and outside the dwellings.

C. Energy measurements

For the energy measurements, three actions were done in each case:

- **Energy bill optimization**

For this analysis, the online service provided by VCE was used. The data required to perform the optimization is: ID card images, last electricity bill and the consent of using the data.

Figure 25. Website of the free of charge service to optimize the electricity bill.

- **Electricity consumption**

For the electricity use, the data is collected from the web site of the electric distribution company platform: www.i-de.es that uses the Meter Point Reference Number (MPRN) to register the energy consumption. The data is available in an hourly basis and since 2018.

The process to obtain the date is:

1. Registration as a client of the contract holder.
2. Authorize third parties to access the contract.
3. Send us the email account used in the registration.
4. Send the contract holder a request for access to the data.
5. Acceptance of the request for access to the data.

Figure 26. Platform of the electric distribution company.

- **Gas consumption**

In the case of dwellings with heating or DHW systems using gas as energy carrier, the consumption is known gathering the gas bills, preferably since 2018 if it was possible. 14 dwellings had gas for heating or DHW.

Figure 27. Example of a gas consumption bill.

D. Health and subjective wellbeing

A questionnaire was prepared to collect the health a subjective wellbeing data of the occupants. They were asked to fill out the questionnaire once a day during the monitoring week. This questionnaire contained:

- Hours of stay in the house.
- Turn on air conditioning? When?
- Thermal discomfort? When?
- Indoor parameters felt? excessive humidity, air stream…
- Occurrence of health symptoms due to indoor environment
- Trotec monitor: Any relevant indicator?

GENERALITAT VALENCIANA
Vicepresidència Segona i Conselleria d'Habitatge i Arquitectura Bioclimàtica

IVE
INSTITUT VALENCIÀ de l'EDIFICACIÓ
INSTITUTO VALENCIANO de la EDIFICACIÓN

This project has received funding from the European Union's H2020 framework programme for research and innovation under grant agreement nº 892749

Participación en la campaña "¡Conoce y mejora tu casa!"

**Esta campaña se enmarca en el proyecto Save the Homes, financiado por la Unión Europea, con el objetivo de acompañar a la ciudadanía en la rehabilitación de sus viviendas a través de un sistema de oficinas de ventanilla única.*

Agradeceríamos responda diariamente a este cuestionario durante la semana en que su vivienda está siendo monitorizada.

	DÍA 1	DÍA 2	DÍA 3	DÍA 4	DÍA 5	DÍA 6	DÍA 7
¿En qué horario has estado/vas a estar en casa?							
¿En qué horario has encendido la climatización?							
¿Has sentido malestar térmico debido a...? Marque con una X.	_Mucho calor _Bastante calor _Algo de calor _Algo de frío _Bastante frío _Mucho frío	_Mucho calor _Bastante calor _Algo de calor _Algo de frío _Bastante frío _Mucho frío	_Mucho calor _Bastante calor _Algo de calor _Algo de frío _Bastante frío _Mucho frío	_Mucho calor _Bastante calor _Algo de calor _Algo de frío _Bastante frío _Mucho frío	_Mucho calor _Bastante calor _Algo de calor _Algo de frío _Bastante frío _Mucho frío	_Mucho calor _Bastante calor _Algo de calor _Algo de frío _Bastante frío _Mucho frío	_Mucho calor _Bastante calor _Algo de calor _Algo de frío _Bastante frío _Mucho frío
¿Recuerdas cuándo has sentido dicho malestar térmico?							
¿Qué parámetros vinculados has detectado? Marque con una X	_Humedad excesiva _Corriente aire	_Humedad excesiva _Corriente aire	_Humedad excesiva _Corriente aire	_Humedad excesiva _Corriente aire	_Humedad excesiva _Corriente aire	_Humedad excesiva _Corriente aire	_Humedad excesiva _Corriente aire
¿Has experimentado algún síntoma como dolor de cabeza, sequedad en los ojos, etc.?							
¿Has detectado algún dato que te haya llamado la atención en el dispositivo de monitorización?							
Comentarios adicionales							

Figure 28. Questionnaire provided to the dwelling's occupants.

4.2.3 Building characteristics and occupants' profile → interview

During the first visit to the dwelling, the technician collected the building/dwelling characteristics and occupants' profile. To facilitate the process, a form with 4 sheets was developed. The first one was completed before the visit using the cadastral reference and the data collected during the selection process. The rest of the sheets were implemented interviewing the occupant/s.

- **Initial data**

The first one contains general data from cadastral and the selection process: personal data, building and facilities data, other available data, renovation measures after 2020 and planned renovation measures in the following months.

- **Dwelling data**

The second one provides data about the dwelling with general information such as number of rooms, use profile, more information about the facilities: lighting, heating systems, cooling systems, ventilation, photovoltaic installation, appliances; and information about building elements: windows, façade, roof, and floor. This information is used as well to elaborate the energy performance certificate (for the cases that chose it as a reward).

- **Subjective wellbeing data**

The third form collects the subjective wellbeing of the occupants living in the dwelling. It asked how often they feel discomfort due to indoor parameters quality such as dry air, humid air, bad smell, noise, air stream, high/low temperatures, etc; the type of discomfort that they usually feel such as

fatigue, headache, dry throat, breathing problems, etc; the general thermal feeling in winter and in summer and the clothing they usually wear in both seasons.

- **Renovation measures data**

Finally, the fourth form deals with the energy renovation measures and there are two types of form depending on the case:

A) Houses that already implemented measures.

In these cases, occupants were asked to explain the measures implemented, when they were done and the reasons to implement them. Then it was asked their appreciation of the measures and the work done, the hardest part of the process and if their problems were solved. They were also asked about the cost of the measures, if they had grants and their experience asking for the grants among others. Finally, they were asked if they planned to do new measures and the reason.

B) Houses that don't have implemented measures yet.

In the second type, when the houses are not renovated, they were asked if they were going to do energy renovation measures, the reason, the budget and if they were going to ask for grants.

Annex 6 – Questionnaire for collecting building characteristics and occupant profile. shows the whole forms used in the interviews with the dwelling's occupants.

4.2.4 Photographic report

In all the cases a photographic report of the outside and inside of the dwelling was made. Special attention was paid in the envelope characteristics and facilities features. The pictures are use as well to elaborate the energy performance certificate.

Figure 29. Example of the photographic report done in each monitoring case.

4.2.5 Other documents prepared.

The organization of the monitoring campaign required to prepare other documents:

- **Monitoring campaign consent**
  Explanation of the Save the Homes project, the monitoring campaign and the consent form.

Participación en la campaña "¡Conoce y mejora tu casa!"

*Esta campaña se enmarca en el proyecto Save the Homes, financiado por la Unión Europea, con el objetivo de acompañar a la ciudadanía en la rehabilitación de sus viviendas a través de un sistema de oficinas de ventanilla única.

Su vivienda ha sido seleccionada para participar en la campaña "¡Conoce y mejora tu casa!", desarrollada por el Instituto Valenciano de la Edificación en el marco del proyecto Save the Homes.

Información general

La información que figura en esta página tiene por objeto ayudarle a comprender exactamente lo que le pedimos para que pueda decidir si desea o no participar en esta campaña. Si decide no participar, no se le reprochará de ninguna manera. Puede abandonar la campaña en cualquier momento.

Objetivo de la campaña

El objetivo de este estudio es recopilar, identificar, analizar y comprender los hábitos y comportamientos relacionados con la energía, junto con los factores humanos (por ejemplo, motivaciones, valores, suposiciones) que influyen en las decisiones y en la (in)voluntad de los usuarios de rehabilitar energéticamente sus viviendas. Los resultados del estudio se utilizarán para el desarrollo de proyectos de investigación e innovación centrados en facilitar a los propietarios de viviendas, así como a los técnicos involucrados en la rehabilitación energética, herramientas de apoyo a la toma de decisiones, validación de la calidad y creación de comunidades.

Privacidad y confidencialidad

Su participación en esta campaña es totalmente voluntaria, su anonimato está garantizado y sus respuestas sólo se utilizarán con fines de investigación. Sus respuestas serán confidenciales y su identidad estará protegida (no se revelará ninguna información personal al público). Todos los datos se transmitirán mediante una conexión segura y encriptada a Internet y se almacenarán en un archivo protegido por contraseña. Reconocemos que esta campaña cumple con los criterios de la normativa nacional y de la UE, también en lo relativo al Reglamento General de Protección de Datos (RGPD).

Daños / beneficios potenciales

No se conocen daños asociados a su participación en esta investigación.

Gracias de antemano por su tiempo y cooperación. Le rogamos que sea sincero(a) en sus respuestas. Las mismas serán muy valiosas para los fines de la campaña. Si tiene alguna pregunta, no dude en formularla.

Consentimiento para la participación en la campaña gratuita "¡Conoce y mejora tu casa!"

Mediante la firma del presente documento:

- Declaro haber sido **informado(a) por escrito** de las condiciones de participación en esta campaña y **ser conocedor(a) de mis opciones** a: -formular preguntas; -reconsiderar mi participación en la campaña;
- Autorizo al personal designado por el Instituto Valenciano de la Edificación para llevar a cabo la **instalación de equipos de monitorización y seguimiento** de las condiciones de la vivienda objeto de estudio, a fin de evaluar el funcionamiento y rendimiento energético de la misma;
- Me comprometo a **facilitar la información de la vivienda objeto de estudio requerida** (CUPS, datos de consumos y hábitos energéticos, información sobre intervenciones llevadas a cabo en la vivienda con anterioridad, etc.);
- Me comprometo a **custodiar los equipos instalados**, y a no manipularlos, maltratarlos o exponerlos a daños durante el tiempo en el que estén instalados en mi vivienda, así como a **permitir la retirada** de los mismos una vez finalizado el periodo de monitorización estipulado;
- **Confirmo mi participación en la campaña y autorizo** al uso de los datos que a través de ella se obtengan con fines de investigación. Doy además permiso a que dichos datos sean almacenados **hasta 15 años después de la finalización del proyecto** Save the Homes.

☐ Autorizo a la realización de **fotografías**, tanto de la vivienda como de mí mismo(a), durante la realización del cuestionario inicial sobre la vivienda;

☐ Autorizo a la realización de **vídeos**, tanto de la vivienda como de mí mismo(a), durante la realización del cuestionario inicial sobre la vivienda.

Nombre y apellidos – DNI: _____

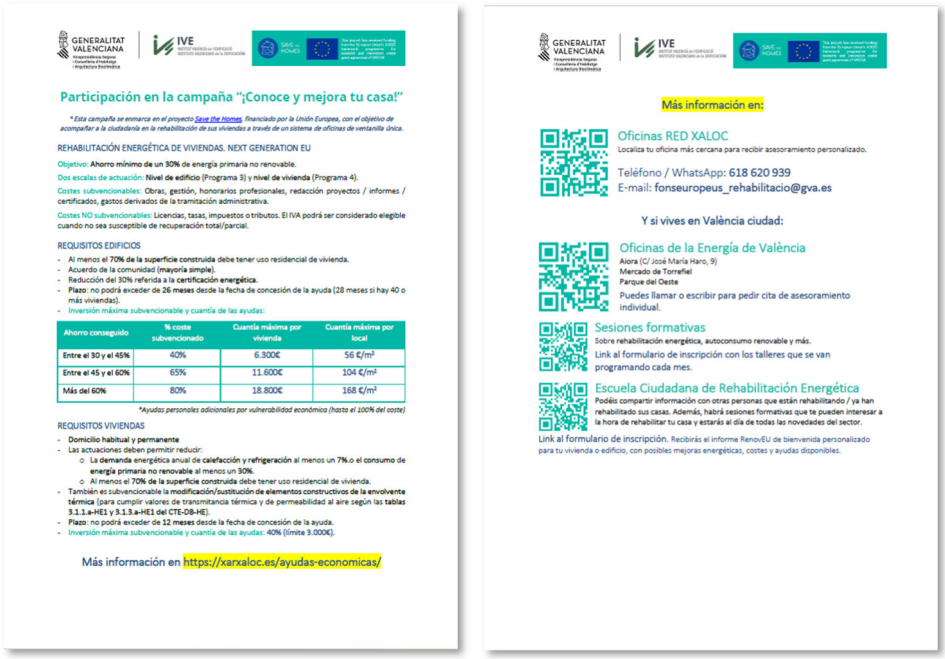
Dirección de la vivienda objeto de estudio:

_____

Fecha y firma:

Figure 30. Document for the monitoring campaign consent.

- **Fact sheet about grants and information**
  - Next Generation grants. Explanation of the available grants and the requirements for both options: buildings and dwellings.
  - Xaloc network and energy offices in Valencia with contact details and QR links to the websites.



Participación en la campaña "¡Conoce y mejora tu casa!"

*Esta campaña se enmarca en el proyecto Save the Homes, financiado por la Unión Europea, con el objetivo de acompañar a la ciudadanía en la rehabilitación de sus viviendas a través de un sistema de oficinas de ventanilla única.

REHABILITACIÓN ENERGÉTICA DE VIVIENDAS. NEXT GENERATION EU

Objetivo: Ahorro mínimo de un 30% de energía primaria no renovable.

Dos escalas de actuación: Nivel de edificio (Programa 3) y nivel de vivienda (Programa 4).

Costes subvencionables: Obras, gestión, honorarios profesionales, redacción proyectos / informes / certificados, gastos derivados de la tramitación administrativa.

Costes NO subvencionables: Licencias, tasas, impuestos o tributos. El IVA podrá ser considerado elegible cuando no sea susceptible de recuperación total/parcial.

REQUISITOS EDIFICIOS

- Al menos el 70% de la superficie construida debe tener uso residencial de vivienda.
- Acuerdo de la comunidad (mayoría simple).
- Reducción del 30% referida a la certificación energética.
- Plazo: no podrá exceder de 26 meses desde la fecha de concesión de la ayuda (28 meses si hay 40 o más viviendas).
- Inversión máxima subvencionable y cuantía de las ayudas:

Ahorro conseguido	% coste subvencionado	Cuantía máxima por vivienda	Cuantía máxima por local
Entre el 30 y el 45%	40%	6.300€	56 €/m²
Entre el 45 y el 60%	65%	11.600€	104 €/m²
Más del 60%	80%	18.800€	168 €/m²

*Ayudas personales adicionales por vulnerabilidad económica (hasta el 100% del coste)

REQUISITOS VIVIENDAS

- Domicilio habitual y permanente
- Las actuaciones deben permitir reducir:
  - La demanda energética anual de calefacción y refrigeración al menos un 7% o el consumo de energía primaria no renovable al menos un 30%.
  - Al menos el 70% de la superficie construida debe tener uso residencial de vivienda.
- También es subvencionable la modificación/sustitución de elementos constructivos de la envolvente térmica (para cumplir valores de transmitancia térmica y de permeabilidad al aire según las tablas 3.1.1.a-HE1 y 3.1.3.a-HE1 del CTE-DB-HE).
- Plazo: no podrá exceder de 12 meses desde la fecha de concesión de la ayuda.
- Inversión máxima subvencionable y cuantía de las ayudas: 40% (límite 3.000€).

Más información en https://xarxaloc.es/ayudas-economicas/

Más información en:

Oficinas RED XALOC
Localiza tu oficina más cercana para recibir asesoramiento personalizado.

Teléfono / WhatsApp: 618 620 939
E-mail: fonseuropeus_rehabilitacio@gva.es

Y si vives en València ciudad:

Oficinas de la Energía de València
Alora (C/ José María Haro, 9)
Mercado de Torrefiel
Parque del Oeste
Puedes llamar o escribir para pedir cita de asesoramiento individual.

Sesiones formativas
Sobre rehabilitación energética, autoconsumo renovable y más.
Link al formulario de inscripción con los talleres que se van programando cada mes.

Escuela Ciudadana de Rehabilitación Energética
Podéis compartir información con otras personas que están rehabilitando / ya han rehabilitado sus casas. Además, habrá sesiones formativas que te pueden interesar a la hora de rehabilitar tu casa y estarás al día de todas las novedades del sector.
Link al formulario de inscripción. Recibirás el informe RenovEU de bienvenida personalizado para tu vivienda o edificio, con posibles mejoras energéticas, costes y ayudas disponibles.

Figure 31. Fact sheet with the Next Generation grants and the Energy Office and Xaloc network information.

- **Fact sheet Trotec BQ30 monitor**.
  Information about the data provided by the monitor and the meaning of the colours.

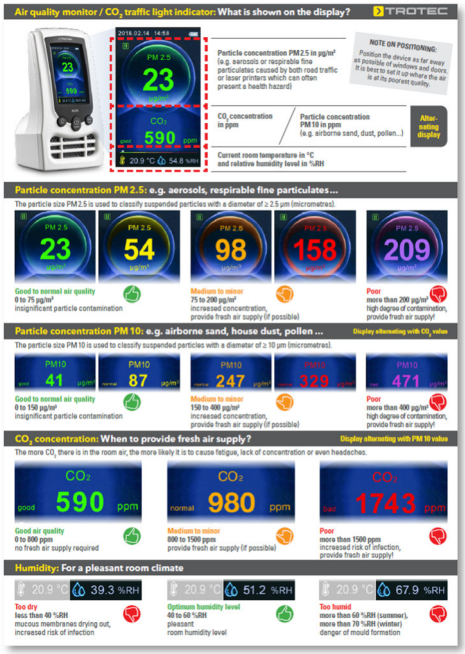


Figure 32. Fact sheet about the indoor environmental quality provided by the Trotec BQ30 monitor.

- **Renovation stories/best practices map consent**
  Information about the renovation stories maps with an example and consent form of the specific parameters they allow to be published on the map. This consent was only shared with the occupants of dwellings that had already done renovation measures.

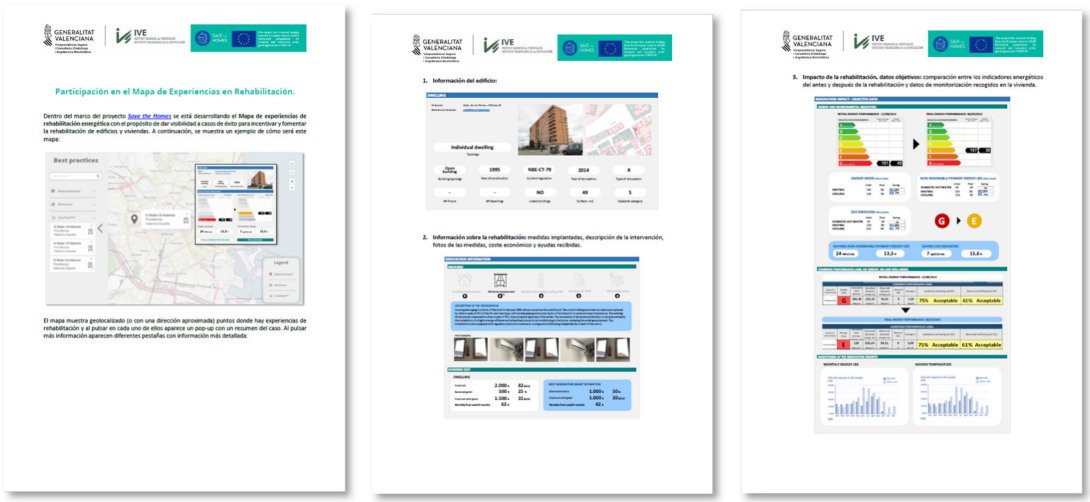


Figure 33. Explanation and consent for the renovation stories map

- **Checklist of the monitoring cases**
  Internal form with all the data to be collected for each case study. It was used to track the information gathered.

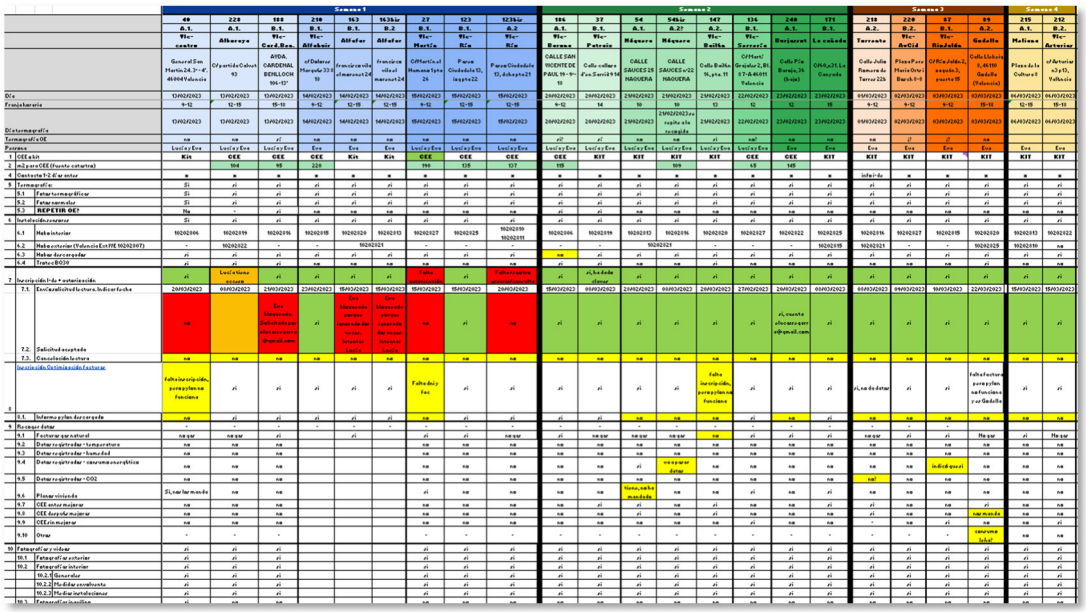


Figure 34. Checklist of the data gathered for each case study during the monitoring campaign.

4.3 Analysis of the monitoring campaigns results

This section presents the results of the monitoring campaign in the Valencia pilot from two perspectives: the monitoring process and the monitoring data gathered.

4.3.1 Evaluation of the monitoring campaign success.

The procedure showed in section 4.1.1 Definition of the evaluation of the monitoring success. Executive Summaryis used to evaluate the performance of the monitoring campaign implemented in the Valencia pilot.

The following table shows the collected variables during the process of the campaign:

Monitoring campaign dissemination

a	Number of people targeted by newsletters/ social media/ workshops…	35.3344
b	Number of people who viewed the monitoring campaign	15.863
c	Number of clicks on the monitoring campaign information	551
d	Number of dwellings registered in the monitoring campaign	252
e	Number of dwellings registered for Scenario A.1: Renovated dwellings (after 2020) that want to implement new measures.	34
f	Number of dwellings registered for Scenario A.2: Renovated dwellings (after 2020) that do not want to implement measures.	15
g	Number of dwellings registered for Scenario B.1: Non-renovated dwellings (after 2020) that want to implement measures.	170
h	Number of dwellings registered for Scenario B.2: Non-renovated dwellings (after 2020) that do not want to implement measures.	33

Monitoring campaign scope

i	Number of monitored dwellings	23
j	Monitored dwellings for Scenario A.1.	6
k	Monitored dwellings for Scenario A.2.	5
l	Monitored dwellings for Scenario B.1.	9
m	Monitored dwellings for Scenario B.2.	3

Monitors performance

n	Total number of monitors	16
o	Number of Hobo monitors (T°C and H%)	13
p	Number of Trotec BQ30 monitors (Air quality)	3
q	Number of dwellings monitored with Hobo	23
r	Number of dwellings monitored with Trotec BQ30	7

Renovation Stories/Best practices map

s	Number of dwellings susceptible to appear on the Renovation Stories/Best practices map.	11
t	Number of dwellings accepting publication on the Renovation Stories/Best practices map.	6

The above variables are combined to calculate different indicators to assess the success of the monitoring campaign. The results are shown in the following table:

1. Monitoring campaign dissemination success

1.1. Views: Number of people who viewed the monitoring campaign information	**b/a**	**45%**	**45%** of people in the target audience viewed the dissemination content.
1.2. CTR Click Trough Rate: Number of people who clicked on the monitoring campaign	**c/b**	**3,5%**	**3,5%** of people who viewed the dissemination content clicked on the monitoring campaign information.
1.3. Conversion Rate: Number of dwellings registered in the monitoring campaign	**d/c**	**45,7%**	**45,7%** of the people who clicked on the monitoring campaign registered
1.4. Scenario A.1. registered rate: Number of dwellings Sc A.1. registered	**e/d**	**13,5%**	**13,5%** of the registered dwellings were A.1 (renovated + upcoming measures)
1.5. Scenario A.2. registered rate: Number of dwellings Sc A.2. registered	**f/d**	**6%**	**6%** of the registered dwellings were A.2 (renovated + no upcoming measures)
1.6. Scenario B.1. registered rate: Number of dwellings Sc B.1. registered	**g/d**	**67,5%**	**67,5%** of the registered dwellings were B.1 (non-renovated + upcoming measures)
1.7. Scenario B.2. registered rate: Number of dwellings Sc B.2. registered	**h/d**	**13,1%**	**13,1%** of the registered dwellings were B.2 (non-renovated + no upcoming measures)

2. Monitoring campaign scope

2.1. Monitoring campaign scope: Monitored dwellings rate	**i/d**	**9,1%**	**9,1%** of the registered dwellings were monitored.
2.2. Scenario A.1. monitored rate: Monitored dwellings Sc A.1. rate	**j/i**	**26,1%**	**26,1%** of the monitored dwellings were A.1 (renovated + upcoming measures)
2.3. Scenario A.2. monitored rate: Monitored dwellings Sc A.2. rate	**k/i**	**21,7%**	**21,7%** of the monitored dwellings were A.2 (renovated + no upcoming measures)
2.4. Scenario B.1. monitored rate: Monitored dwellings Sc B.1. rate	**l/i**	**39,1%**	**39,1%** of the monitored dwellings were B.1 (non-renovated + upcoming measures)
2.5. Scenario B.2. monitored rate: Monitored dwellings Sc B.2. rate	**m/i**	**13%**	**13%** of the monitored dwellings were B.2. (non-renovated + no upcoming measures)

3. Monitors' implementation and performance

3.1. Dwellings with Hobo monitors rate	**q/i**	**100%**	**100%** of the monitored dwellings had Hobo monitors.
3.2. Dwellings with Trotec BQ30 monitors rate	**r/i**	**30,4%**	**30,4%** of the monitored dwellings had Trotec BQ30 monitors.
3.3. Total monitors' performance	**i/n**	**1,44**	With each monitor, **1.44** dwellings have been monitored
3.4. Hobo monitors' performance	**q/o**	**1,77**	With each Hobo monitor, **1.77** dwellings have been monitored
3.5. Trotec BQ30 monitors' performance	**r/p**	**2,33**	With each Trotec BQ30 monitor, **2,33** dwellings have been monitored

4. Renovation Stories/Best practices map success

4.1. Renovation stories map rate: Monitored dwellings susceptible to be included on the map	**s/i**	**47,8%**	**47,8%** of the monitored dwellings were susceptible to be included on the map.
4.2. Renovation stories map success rate	**t/s**	**54,5%**	**54,5%** of the susceptible monitored dwellings to be included on the map accepted.

If we analyse those indicators in the customer journey validation dashboard, we observe the following trends:

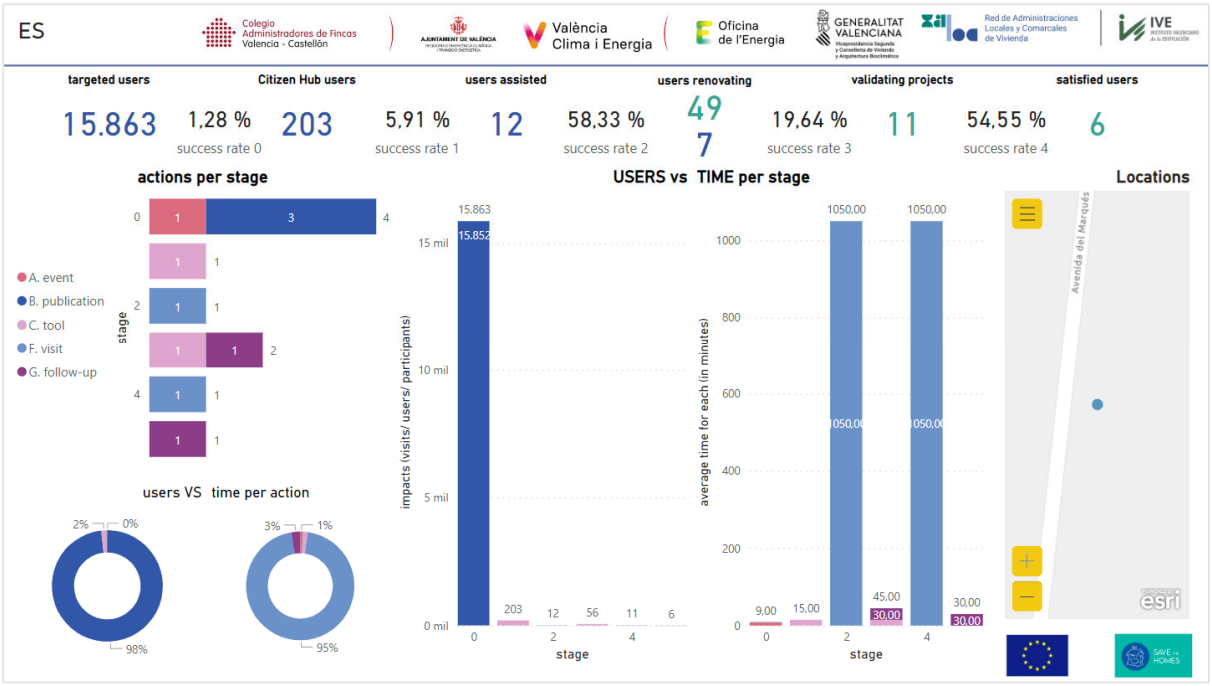


Figure 35.- Customer journey assessment dashboard filtered for monitoring actions.

The customer journey assessment dashboard, filtered for focusing on the monitoring activities shows some of the previous data in a visual way, where we can see:

- Onboarding actions target and reach many citizens, in the form of events and publications, which, even if they consume some time, worth the effort when compared to the average time dedicated to each potential user.
- For this reason, actions are focused on that stage. Even when its conversion rate is quite low (slightly over a 1%), it is enough, since more than 200 applicants for monitoring is in fact too high!
- Nevertheless, management of applications is simple because of the use of just one automated process (tool), making the selection easier and the time spent efficient.
- It is to be noted that the low conversion rate into stage 2 (users assisted in the design of their potential renovation, i.e., dwellings monitored in a pre-renovation stage, and therefore advised) was due to the limited resources of the OSS to perform the monitoring (human resources, sensors and monitors)
- Post-renovation monitoring was quite less successful than pre-monitoring, which is evident because of the reduced incentives (they already renovated)
- Even so, more than a half of them found the experience interesting enough to consent to share it with other users, in order to let them know the benefits of their renovation.
- The negative side of these data is the monitoring actions themselves, in terms of time spent. This has two readings: on one hand, some actions (e.g., visits) consume too much time, so they do not worth it; but on the other hand, they throw high conversion rates and help to validate or improve the customer journey and explain the benefits of the renovation and drawn attention to its bottlenecks or problems.
- When comparing time spent per user, automatization is something to address, since it has proven to be highly efficient.
- When comparing users reached, publications are the most effective.
- When comparing conversion rates, visits are the most successful.

As a conclusion, a higher level of automatization in the monitoring activities could allow for repeating these campaigns at least once a year, so renew success stories and best practices, and re-evaluate the services offered by the OSS.

The following table shows the data collected during the monitoring campaign. When the number is coloured green means that the data is completed, and the information was correctly gathered, or the occupant provided the information. If it is orange, it means that some data is still missing.

Monitoring set	Indoor Environmental Quality	Hobo data logger - T°C/RH%	**23/23**
		Trotec BQ 30 - CO2, PM, T°C/RH%	**7/7**
	Energy measurements	Energy bill optimization - Online	**15/23**
		Electricity consumption - Utility	**17/23**
		Gas consumption - Bills	**14/14***
	Thermographic study - Indoor/outdoor		**23/23****
	Health and subjective wellbeing - Questionnaire		**23/23**
Building characteristics and occupant profile - Interview	Initial data		**22/23**
	Dwelling data		**22/23**
	Subjective wellbeing data		**22/23**
	Renovation measures data - Done or Planned		**22/23**
Photographic report	Indoor		**23/23**
	Outdoor		**23/23**
Other documents	Monitoring campaign consent		**23/23**
	Fact sheet about grant and information		**23/23**
	Fact sheet Trotec BQ30 monitor		**7/7**
	Renovation stories map consent		**6/11**
Reward	Energy performance certificate		**7/9**
	Energy efficiency kit		**14/14**
Recommendations report	Recommendations reports done		**0/23**
	Recommendations reports delivered		**0/23**

**It reflects the dwellings that provided gas consumption bills, but it is still required to check if all the dwellings have provided bills since 2018.*

*** Despite most of the dwellings switched on the heating system 2 hours before the study, in some cases the thermal contrast between the outside and the inside of the dwelling was not enough. In these cases, the thermographic study could be redone in summer to try to get better results.*

As a conclusion, data collection that relies solely on the technician is easier to collect than data that relies on the occupant. This is seen in the energy measurements. Since the occupants had to provide documents and register online, we still do not have some of them. In some cases, the problem was due to difficulties with the website or app (people with low technological skills) and in other cases the problem was due to a lack of interest on the part of the owner.

At this point, we list below the conclusions that can be drawn so far:

- **Monitoring campaign**
  - People showed special interest in the thermographic photos because it is a very visual and easy to understand tool → Energy offices could have a lending service and provide a thermographic camera and a brief explanation of how to use it to allow them to do a thermographic study of their houses.
- **Indoor environmental quality**
  - People also showed much interest in the Trotec BQ30 monitor. For example, the owners of one of the monitored dwellings were concerned about the level of CO2 in their dwelling during

the monitoring week and bought a CO2 monitor and installed it in their house. Now they are ventilating the house twice otherwise the CO2 level rises too much → Energy offices could have a rental service and provide this type of sensors to encourage people to monitor their indoor air quality.

- People are not aware of how harmful it is to live in unhealthy environments, for example, with damp and mould on their walls. → More awareness is required

- **Renovation process**
  - In many cases the neighbours community is the biggest obstacle to perform a deep renovation of the whole building → More awareness is required
  - Some of them complained about the work done (PV installers not qualified) → More training in energy renovation for installers and builders is required
  - Some of them did a whole renovation without energy efficiency perspective or focused only in PV → More training in energy renovation for architects and technicians is required
  - In some cases the community agrees to renovate but for other reasons → IEE (Building evaluation report) must be exploited
- **Renovation grants**
  - Some had problems with NextGeneration grants (burocracy, not expert technicians...) → More certiffied experts and training in managing grants are required
- **Other**
  - In some cases the property manager does not promote the renovation → More training/incentives are require for property managers

After implementing the monitoring campaign and having had direct contact with the home-owners of the monitred dwellings (who are the potential users of the customer journey), some important conclusions can be drawn and implemented in the OSS: awareness and/or specific training of all the customer journey stakeholders is key: users, technicians, property managers, neighbours community, etc. On the other hand, providing users with a lending service of self-use monitoring tools can improve user's engagement and boost renovations processes.

4.3.2 Evaluation of the data collected during the monitoring campaign.

As indicated in section 4.3.1 Evaluation of the monitoring campaign success, 252 homes registered to participate in the monitoring campaign, 23 of which were selected.

Also as already indicated in section 4.3.2, the 23 selected dwellings covered the following scenarios:

Monitoring campaign scope	
Number of monitored dwellings	23
Monitored dwellings for Scenario A.1: Renovated dwellings (after 2020) that want to implement new measures.	6 (26%)
Monitored dwellings for Scenario A.2: Renovated dwellings (after 2020) that do not want to implement measures.	5 (22%)
Monitored dwellings for Scenario B.1: Non-renovated dwellings (after 2020) that want to implement measures.	9 (39%)
Monitored dwellings for Scenario B.2: Non-renovated dwellings (after 2020) that want to implement measures.	3 (13%)

It should be noted that the 23 selected dwellings have also tried to cover two main typologies: single-family dwellings and dwellings located in multi-family buildings:

Monitored dwellings	
Single-family houses.	07/23 (30%)
Dwellings in multi-family houses.	16/23 (70%)

It should also be noted that the selection of both typologies has been carried out trying to maintain the percentage of typologies of the housing stock in the Valencia region. An attempt is made to summarize graphically in tables the main data on the age and the location of the selected dwellings:

	LOCATION		YEAR OF CONSTRUCTION									
	City of Valencia itself	Towns in Valencia province	Before 1900	1900-1920	1921-1940	1941-1950	1951-1960	1961-1970	1971-1980	1981-1990	1991-2001	2002-2011
SINGLE-FAMILY HOUSES	0/7	7/7	-	1	-	-	1	-	-	1	-	4
Dwellings in MULTI-FAMILY HOUSES	13/16	3/16	-	-	1	-	1	6	3	-	4	1
	13/23	**10/23**	**-**	**1**	**1**	**-**	**2**	**6**	**3**	**1**	**4**	**5**

The location of the dwellings can also be seen on the map in section 4.2.1.c. It should be noted that all the single-family houses selected are located outside the city of Valencia (in other localities of the province) while practically all the dwellings located in multi-family buildings (more than 80% of them) are located in the city itself.

As for the age of the selected housing stock, while most of the single-family houses are of relatively recent construction (about 67% of them are from 2005 and 2006), more than half of the dwellings in multi-family houses (12 out of 23) predate 1979, when energy insulation of buildings was not mandatory.

A. Energy

Another interesting fact to highlight about the selected housing stock is the fact of having already been retrofitted or not. An effort has also been made to try to include dwellings in which energy renovation actions have been carried out. The higher percentage of energy retrofitted single-family houses (more than 70%) compared to only 25% of energy renovation actions in the case of multi-family houses stands out significantly:

	ENERGY RETROFITTING DATA					
	Recently refurbished	Insulation	Windows	PV	Aerothermal	Several
SINGLE-FAMILY HOUSES	5/7	3/5	3/5	4/5	2/5	3/5
ings in MULTI-FAMILY HOUSES	4/16	1/4	3/4	2/4	0/4	1/4
	9/23	**4/9**	**6/9**	**6/9**	**2/9**	**4/9**

The type of interventions carried out also seems representative depending on the housing typology: while in the case of the selected single-family houses, 60% have implemented several energy renovation measures, in the case of the selected dwellings located in multi-family houses the most common is to carry out punctual interventions, with window replacement being the most common measure (75% of the rehabilitated houses).

With respect to non-retrofitted dwellings, an attempt is also made to graphically summarize some of the main data on their energy status:

	NON RECENTLY REFURBISHED DWELLINGS							
	ENERGY CONSUMPTION						ENERGY LABEL	
	Potential reduction in average anual consumption >40%	Potential reduction in average anual consumption >50%	Potential reduction in average anual consumption >60%	Potential reduction in average anual consumption >70%	Potential reduction in average anual consumption >80%	Potential reduction in average anual consumption >90%	E	D
-FAMILY HOUSES	-	-	-	-	-	-	-	2/2
MULTI-FAMILY HOUSES	8/12	7/12	6/12	3/12	2/12	1/12	9/12	3/12
							9/14	5/14

As can be seen in the table, 75% of the non-retrofitted dwellings located in multi-family buildings have an E rating. Half of them (of the non-retrofitted dwellings located in multi-family buildings) could have a potential of reduction of more than 60% of their average annual consumption.

B. Indoor conditions

As in the beginning of the basic data analysis of the monitored dwellings above, an attempt has been made to break down the results for the typologies of dwellings participating in the campaign:

	INDOOR CONDITIONS			
	ONLY TEMPERATURE	ONLY HUMIDITY	TEMPERATURE + HUMIDITY	GENERAL
	Time in discomfort > Time in comfort	Time in discomfort > Time in comfort	Time in discomfort > Time in comfort	Time in discomfort > Time in comfort
SINGLE-FAMILY HOUSES	-	-	1/7	3/4
Dwellings in MULTI-FAMILY HOUSES	2/7	1/7	3/7	6/9
	2/7	1/7	4/7	9/13
	Data only broken down for 7 dwellings (1 SFH + 6 dwellings in MFH)			*Aggregate data for 13 dwellings*

In the case of single-family houses, there are data for 5 of the 7 participating in the monitoring campaign. In 80% of them (4 dwellings), the percentage of time out of comfort has always been higher than that recorded in comfort conditions. It should be noted that, in 3 of them, the time out of comfort has been between 96-100% of the monitored time, despite the fact that all 3 have undergone some type of energy renovation.

As per the dwellings in multi-family houses, data are available for 15 of the 16 dwellings. As in the case of the single-family houses, in 80% of them (12 dwellings), the recorded percentage of time out of comfort has always been higher than that recorded in comfort conditions. However, only two of these dwellings have undergone some renovation action. Regarding the reason/degree of discomfort, the most common was experiencing temperature below and humidity above the comfort ranges.

C. Health and subjective well-being

As explained in 4.1.7, a health and subjective well-being questionnaire was also created and distributed among the occupants of the dwellings to obtain -although not directly- data on their IEQ. Through the questionnaires, occupants were asked about health symptoms experienced at home, as well as about their general thermal sensation and other environmental conditions:

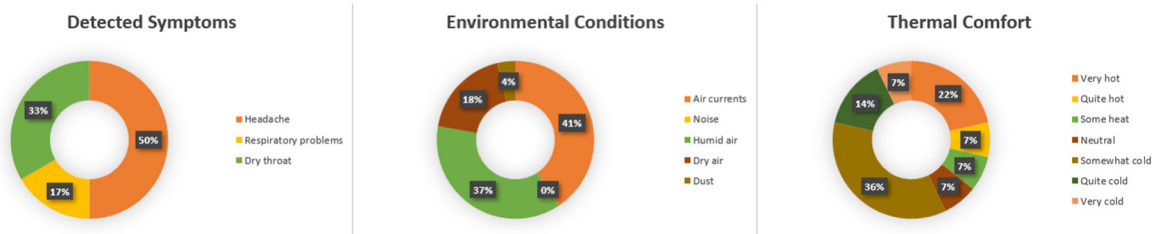


Figure 36.- Health and subjective wellbeing results

- Regarding the **health symptoms** detected, about 20% of the participating households (80% of which are dwellings located in multi-family buildings) expressed to have experimented some symptom, mainly headache or dry throat.
- Regarding **environmental conditions**, a distinction should be made between the general perception of the occupants of single-family houses or of dwellings in multi-family buildings: while the presence of air currents and noise affect about half of the apartments, humid air is the main problem reported in single-family houses (in more than 80% of them, compared to 40% of the apartments).
- With respect to the **thermal sensation**, the feeling of being somewhat cold is the majority in single-family homes (67% of them). In the case of apartments, the sensation of being very hot in the summer months or somewhat cold in the rest of the year is similar (30%).

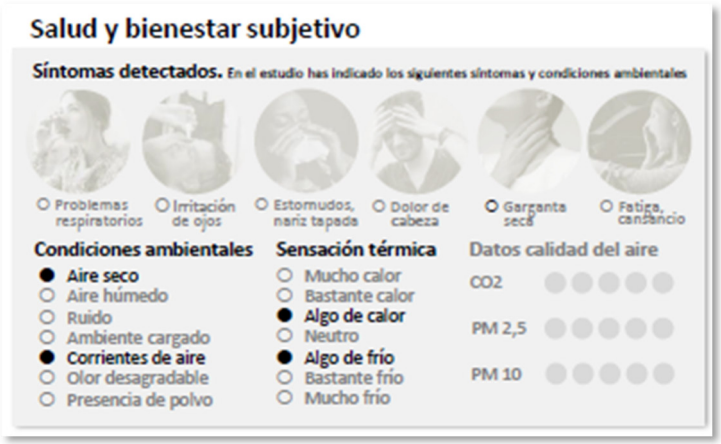


Figure 37.- Example on the health and subjective well-being expressed by the occupants of a dwelling having participated in the monitoring campaign. Information included in the Recommendation Report (Annex 7)

D. Potential measures with no financial investment to be implemented

As part of the information provided at the end of the monitoring campaign, the occcupants of the homes were provided with a series of energy saving and well-being improvement measures -relatively easy to implement and at low or even no cost. The main measures proposed, of a personalized nature based on the observations made during the visits to the dwellings and on the data collected (energy consumption, monitoring, occupant questionnaires, etc.) are as follows:

- **Measures at no economic cost**:
  - **For energy savings**. In both types of dwellings, advice was provided to users on the use of heating, where high savings potential was detected. The anticipation of energy bills (to avoid estimated readings) was recommended to occupants too. In the case of single-family homes, room for improvement was also observed in hot water consumption, while in the case of apartments, a wide margin for optimisation was detected in the consumption of household appliances and lighting.
  - **For the improvement of well-being**, improvements were recommended to promote natural ventilation and the use of solar protection elements (blinds and curtains), following the general observation of no/low use of these measures in both housing typologies. Other measures recommended were the use of thermal inertia (taking it into account and taking advantage of it) and the optimization of thermostats.

Figure 38.- Example of potential no-cost measures recommended for one of the homes participating in the campaign

- **Low-cost measures**:
  - **For energy saving.** In both housing typologies, the use of saving devices and systems for electricity and water was recommended, after observing a wide margin for improvement through both measures.
  - **For the improvement of well-being.** Measuring air quality and using vegetation was recommended to occupants of both building typologies to improve comfort. Margin for improvement was also detected through mechanical ventilation. Other measures, such as air purifiers/humidifiers or CO_2 and humidity monitoring, were only noted as necessary -and therefore recommended- in very specific cases.

Figure 39.- Example of potential low-cost measures recommended for one of the homes participating in the campaign

E. Interventions requiring an economic investment

In addition to the above measures, eight renovation scenarios, with different economic costs and also different energy savings/emission reduction potentials, were proposed for dwellings that had not

undergone any renovation in recent years (in total, 13 dwellings in multi-family buildings and 2 single family houses).

In these scenarios, the cost of the interventions (with and without subsidy) and the energy label, emissions reduction and energy savings obtained through them have been rated.

		DWELLINGS IN MULTI-FAMILY BUILDINGS													SINGLE-FAMILY HOMES	
	MEASURES INVOLVING FINANCIAL INVESTMENT	#27	#37	#40	#87	#123	#136	#147	#163	#186	#188	#210	#212	#220	#171	#171*
1	Total cost without grant	13.459 €	16.618 €	13.459 €	13.460 €	16.618 €	13.459 €	16.618 €	41.374 €	8.802 €	16.618 €	13.459 €	17.055 €	16.618 €	15.550 €	47.281 €
	Estimated grant	0 €	10.802 €	0 €	0 €	6.300 €	0 €	6.300 €	11.600 €	3.520 €	6.300 €	0 €	11.085 €	6.300 €	6.220 €	11.600 €
	Final cost	13.459 €	5.816 €	13.459 €	13.460 €	10.318 €	13.459 €	10.318 €	29.774 €	5.282 €	10.318 €	13.459 €	5.970 €	10.318 €	9.330 €	35.681 €
	Emissions reduction	16%	52%	15%	16%	36%	16%	36%	60%	47%	36%	16%	58%	36%	29%	49%
	Energy savings	18%	50%	15%	18%	30%	18%	30%	59%	36%	30%	18%	56%	30%	30%	49%
	Label	D - D	E - D	D - D	D - D	E - D	D - D	E - D	E - C	E - D	E - D	D - D	E - D	E - D	D - D	D - C
2	Total cost without grant	3.188 €	4.185 €	3.188 €	3.189 €	4.185 €	3.188 €	4.185 €	6.481 €	4.185 €	4.185 €	3.188 €	5.881 €	4.185 €	8.370 €	7.058 €
	Estimated grant	1.275 €	1.674 €	2.073 €	1.275 €	1.674 €	1.275 €	1.674 €	0 €	1.674 €	1.674 €	1.275 €	3.822 €	1.674 €	0 €	2.823 €
	Final cost	1.913 €	2.511 €	1.115 €	1.914 €	2.511 €	1.913 €	2.511 €	6.481 €	2.511 €	2.511 €	1.913 €	2.059 €	2.511 €	8.370 €	4.235 €
	Emissions reduction	35%	33%	57%	35%	28%	35%	28%	20%	41%	28%	35%	54%	28%	22%	28%
	Energy savings	39%	44%	57%	39%	31%	39%	31%	27%	38%	31%	19%	56%	31%	26%	33%
	Label	D - C	E - E	D - C	D - C	E - D	D - C	E - D	E - E	E - D	E - D	D - C	E - D	E - D	D - D	D - C
3	Total cost without grant	10.717 €	11.583 €	10.717 €	10.717 €	11.583 €	10.717 €	11.583 €	11.583 €	11.583 €	11.583 €	10.717 €	10.717 €	11.583 €	10.717 €	10.717 €
	Estimated grant	6.966 €	9.267 €	6.966 €	6.966 €	4.633 €	6.966 €	4.633 €	7.529 €	7.529 €	4.633 €	6.966 €	8.574 €	4.633 €	0 €	6.966 €
	Final cost	3.751 €	2.316 €	3.751 €	3.751 €	6.950 €	3.751 €	6.950 €	4.054 €	4.054 €	6.950 €	3.751 €	2.143 €	6.950 €	10.717 €	3.751 €
	Emissions reduction	52%	67%	53%	52%	50%	52%	50%	52%	59%	50%	52%	66%	50%	39%	58%
	Energy savings	45%	65%	53%	45%	44%	45%	44%	52%	50%	44%	45%	65%	44%	29%	51%
	Label	D - C	E - C	D - C	D - C	E - C	D - C	E - C	E - D	E - C	E - C	D - C	E - D	E - C	D - C	D - B
4	Total cost without grant	8.393 €	9.522 €	8.393 €	8.393 €	9.522 €	8.393 €	9.522 €	15.847 €	1.706 €	9.522 €	8.393 €	9.460 €	9.522 €	14.815 €	17.542 €
	Estimated grant	5.456 €	0 €	5.456 €	5.456 €	0 €	5.456 €	0 €	6.300 €	682 €	0 €	5.456 €	0 €	0 €	9.630 €	11.402 €
	Final cost	2.937 €	9.522 €	2.937 €	2.937 €	9.522 €	2.937 €	9.522 €	9.547 €	1.024 €	9.522 €	2.937 €	9.460 €	9.522 €	5.185 €	6.140 €
	Emissions reduction	53%	21%	54%	53%	31%	53%	31%	30%	43%	31%	53%	20%	31%	62%	61%
	Energy savings	47%	21%	54%	47%	27%	47%	27%	30%	34%	27%	47%	20%	27%	54%	54%
	Label	D - C	E - E	D - C	D - C	E - D	D - C	E - D	E - E	E - D	E - D	D - C	E - E	E - D	D - B	D - B
5	Total cost without grant	16.648 €	20.804 €	16.648 €	16.648 €	20.804 €	16.648 €	20.803 €	47.856 €	12.987 €	20.804 €	16.648 €	22.935 €	20.804 €	23.920 €	54.339 €
	Estimated grant	10.822 €	16.643 €	13.319 €	10.822 €	16.643 €	10.822 €	16.643 €	18.800 €	10.390 €	16.643 €	10.822 €	18.348 €	16.643 €	6.300 €	18.800 €
	Final cost	5.826 €	4.161 €	3.329 €	5.826 €	4.161 €	5.826 €	4.160 €	29.056 €	2.597 €	4.161 €	5.826 €	4.587 €	4.161 €	17.620 €	35.539 €
	Emissions reduction	55%	77%	72%	55%	78%	55%	78%	79%	82%	78%	55%	90%	78%	41%	65%
	Energy savings	49%	76%	72%	49%	76%	49%	76%	83%	65%	76%	49%	89%	76%	44%	67%
	Label	D - C	E - C	D - B	D - C	E - B	D - C	E - B	E - B	E - B	E - B	D - C	E - B	E - B	D - C	D - B
6	Total cost without grant	13.906 €	15.768 €	13.906 €	13.906 €	15.768 €	13.906 €	15.768 €	18.065 €	15.768 €	15.768 €	13.906 €	16.598 €	15.768 €	19.088 €	17.776 €
	Estimated grant	11.125 €	12.615 €	11.125 €	11.125 €	12.615 €	11.125 €	12.615 €	14.452 €	12.615 €	12.615 €	11.125 €	13.279 €	12.615 €	15.270 €	14.221 €
	Final cost	2.781 €	3.153 €	2.781 €	2.781 €	3.153 €	2.781 €	3.153 €	3.613 €	3.153 €	3.153 €	2.781 €	3.319 €	3.153 €	3.818 €	3.555 €
	Emissions reduction	93%	87%	93%	93%	80%	93%	80%	67%	83%	80%	93%	93%	80%	100%	86%
	Energy savings	92%	86%	93%	92%	78%	92%	78%	69%	80%	78%	92%	93%	78%	100%	85%
	Label	D - A	E - B	D - A	D - A	E - B	D - A	E - B	E - C	E - B	E - B	D - A	E - A	E - B	D - A	D - A
7	Total cost without grant	13.707 €	13.707 €	11.582 €	11.582 €	13.707 €	13.707 €	13.707 €	22.329 €	5.891 €	13.707 €	13.707 €	15.341 €	13.707 €	23.186 €	24.600 €
	Estimated grant	8.910 €	5.483 €	9.266 €	9.266 €	8.910 €	8.910 €	8.910 €	11.600 €	4.712 €	8.910 €	8.910 €	9.971 €	8.910 €	18.549 €	18.800 €
	Final cost	4.797 €	8.224 €	2.316 €	2.316 €	4.797 €	4.797 €	4.797 €	10.729 €	1.179 €	4.797 €	4.797 €	5.370 €	4.797 €	4.637 €	5.800 €
	Emissions reduction	93%	41%	94%	93%	61%	93%	61%	47%	68%	61%	93%	50%	61%	100%	93%
	Energy savings	93%	42%	94%	93%	59%	93%	59%	49%	63%	59%	93%	52%	59%	100%	93%
	Label	D - A	E - E	D - A	D - A	E - C	D - A	E - C	E - D	E - C	E - C	D - A	E - E	E - C	D - A	D - A
8	Total cost without grant	25.240 €	30.240 €	25.240 €	25.241 €	30.240 €	25.240 €	30.240 €	57.292 €	22.424 €	30.240 €	25.240 €	31.527 €	30.240 €	32.513 €	62.932 €
	Estimated grant	18.800 €	18.800 €	18.800 €	18.800 €	18.800 €	18.800 €	18.800 €	18.800 €	17.939 €	18.800 €	18.800 €	18.800 €	18.800 €	18.800 €	18.800 €
	Final cost	6.440 €	11.440 €	6.440 €	6.441 €	11.440 €	6.440 €	11.440 €	38.492 €	4.485 €	11.440 €	6.440 €	12.727 €	11.440 €	13.713 €	44.132 €
	Emissions reduction	98%	98%	98%	98%	97%	98%	97%	99%	98%	97%	98%	100%	97%	100%	98%
	Energy savings	98%	98%	98%	98%	97%	98%	97%	99%	97%	97%	98%	100%	97%	100%	98%
	Label	D - A	E - A	D - A	D - A	E - A	D - A	E - A	E - A	E - A	E - A	D - A	E - A	E - A	D - A	D - A

Figure 40.- Internal working document. Main data on the interventions requiring an economic investment per dwelling

The eight proposed renovation scenarios are as follows:

1. Actions on the thermal envelope (including window replacement).
2. Photovoltaics.
3. Appliances replacement (installation based on a single heat pump, air/water or aerothermics).
4. Window replacement + aerothermics for DHW.
5. Actions on the thermal envelope + photovoltaics (1 + 2).
6. Appliances replacement + photovoltaics (2 + 3).
7. Window replacement + aerothermics for DHW + photovoltaics (2 + 4).
8. Actions on the thermal envelope + appliances replacement + photovoltaics (1 + 2 + 3).

Some interesting conclusions drawn from the analysis of the proposed renovation scenarios would be, in the case of dwellings located in multi-family buildings:

- The minimum benefit of the lower impact interventions (measures 1 and 4) would result in a minimum reduction of CO_2 emissions of 15% and energy savings of 18%, with average reductions of around 30%.
- Measures such as appliances replacement, with an estimated average cost of about 11,000€ per dwelling (without taking subsidies into account), would lead to a reduction of at least 50% of emissions and 44% of energy savings, reaching a reduction of more than 50% of energy savings in some cases.
- All homes would have the capacity to achieve an A energy label (being the initial one D or E) by implementing comprehensive actions (intervention on the thermal envelope +

replacement of equipment + photovoltaic installation), which would result in a reduction of more than 90% of emissions and energy consumption in them.

In the case of single-family houses, although the size of the sample is not as representative since renovation scenarios have only be proposed for two homes, it should be noted that the reductions achieved through these renovation scenarios both in terms of CO_2 emissions and energy consumption would always be higher, as would logically be the cost of the interventions.

5 Rotterdam Citizen Hub

5.1 Design of the monitoring plan

Change towards energy reduction

The climate is changing worldwide and also in the Netherlands. The average temperature over the past century has risen, the amount and intensity of precipitation has increased and very hot days are more common. Achieving the Paris climate goals (2015) is necessary to prevent further global warming and its consequences as much as possible. To comply with the Paris agreements, the Netherlands must switch from fossil fuels to sustainable energy sources such as solar and wind. The (draft) Climate Agreement lays down the measures and agreements for this energy transition. The goal of the Climate Agreement is a reduction of greenhouse gases by 49% in 2030 and by 95-100% in 2050. The measures in the Climate Agreement can yield benefits for health, safety and nature due to the disappearance of fossil sources. In order to make use of the opportunities for health, safety and nature in realizing the energy transition and to prevent or limit negative effects as much as possible, further systematic assessment of this is necessary.

In the last years quite a lot of steps have been taken for home-owners in terms of reducing the energy usage in their homes. One of these things in order to make this easier is the use of smart meters. The large-scale 'roll-out' of the smart meters started in January 2015. By the end of 2022, the smart meter has been offered to virtually all households and over 80 percent of the households has a smart meter. Each network operator has a schedule of who will receive a smart meter and when.

Change towards cost reduction

In regards to the monitoring plan for the Dutch demo case, it differs quite a bit from the Valencia demo case. This is the case because of the availability and resources that are available in the Netherlands. Our current society allows home-owners to take steps into looking in their energy uses of their home without any extra facilities. These facilities were also available when the project started, but because of rather low energy prices people did not look at it. In the past most people paid a monthly amount, got a yearly bill, but most people did not know how much energy they used throughout the year. Now, because of rising energy prices, people are more aware of their energy use and are using the means available. Energy company's all provide a way to measure the individual energy consumption, based on the data from the smart meter. That means additional measuring is not always necessary. But getting people to know that it is available could be improved.

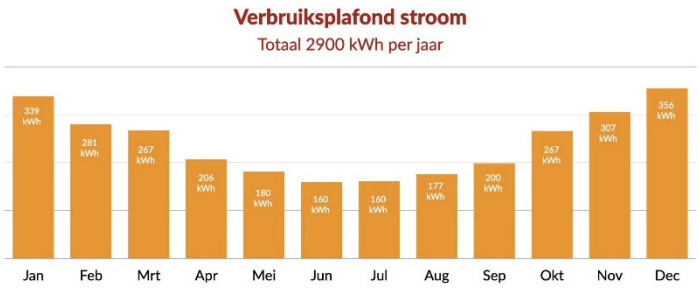


Figure 41 Division of the electricity cap over the year

Due to the rising energy prices the Dutch government introduced a energy-cap for 2023. This means that each individual household gets to pay a guaranteed price of € 0,40 / kWh and €1,45 / m3 gas or € 47,38 / GJ. These are the prices for the first 2.900 kWh and 1.200 m3 and 37 GJ. After that, commercial prices have to be paid. This energy-cap is divided over the whole year. With this

(temporary) measure people want to know better how their energy use is, so energy company's show this in their overview. This government measure makes people more aware of their energy bills.

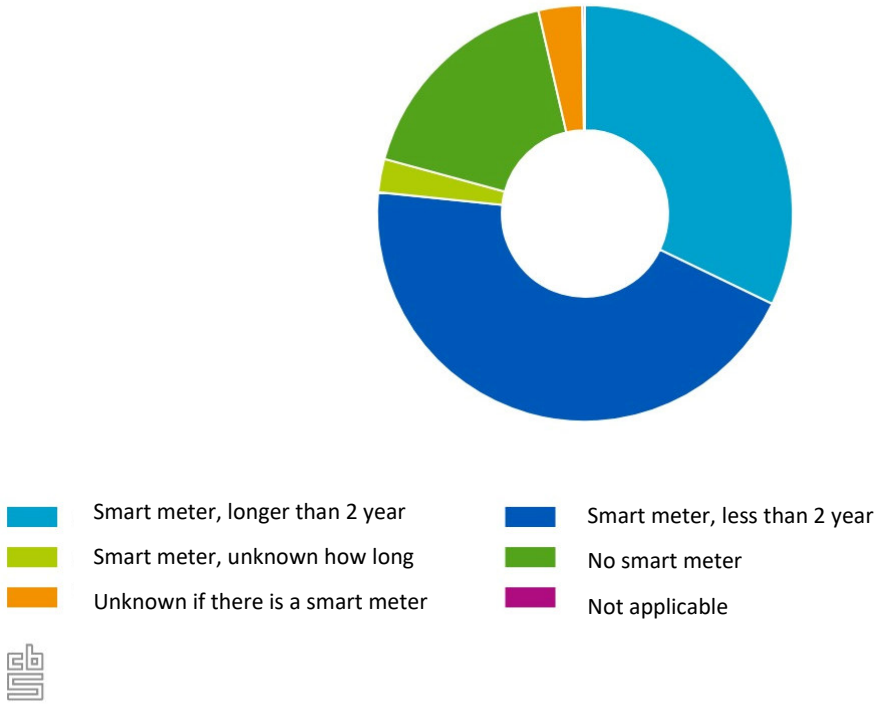


Figure 42 Availability of smart meters in dwellings (2020)

Because of this smart meter the use of a monitoring campaign in the Netherlands is a bit different as people can monitor the energy usage themselves. Therefore, it would only be an added value if we were to retrieve the data – with permission of course – from before and after the renovation from the energy companies. The Sensi – that do measure these energy usages and health of the homes – have had a different function in the last years as it was a measure used for raising awareness about energy and health. Due to the war in Ukraine and the rising gas prices, people now know about the urgency to do something about their homes, mainly due to the ever rising costs associated with gas. The Smart meter and the Sensi will be explained in the following paragraphs.

5.1.1 Smart meter

The smart meter is a digital meter whose readings are read remotely by the energy supplier and the network operator. You no longer have to pass on meter readings to your energy supplier. And there is no longer a need for a meter reader to come by once a year. The smart meter measures your power consumption and transmits the readings of the gas meter. Old gas meters cannot 'talk' to the smart meter. That is why the network operator replaces it at the same time as the electricity meter.

The smart meter sends meter readings via the mobile telephone network (GPRS or CDMA), not via WiFi. The smart meter itself has a kind of built-in mobile phone. So you don't need an internet connection or mobile phone. That data connection is called the 'P3 port'. And the network operator's computer server where the data is collected is called the 'P4 port'.

You do not save energy with just the smart meter, it is merely for registration. But thanks to the monthly consumption and cost overview from the energy supplier, you can keep track of your consumption. It is even possible let the energy company show your daily consumption, and (with extra tools) you can manage your real-time consumption. So with the smart meter, you can check more easily and quickly whether your consumption does not increase unexpectedly. However, energy suppliers do not take any action if your consumption suddenly rises sharply, that is up to yourself. If you do not want to share data with the energy supplier they can switch of the communication. In that case no data will be sent and you still are asked to report your meter readings once a year. But switching off the data has to be requested, the default is data switched on.

This kind of monitoring has also advantages for grid operators. They can detect and rectify faults more quickly and cheaply, thanks to smart meters. The network operator no longer has to wait for telephone reports of power outages in a district. Or dig in 20 gardens to find a loose connection in the power grid. Unsafe (fire) situations are also more likely to be noticed, such as the illegal tapping of power. Because smart meters of local residents, for example, show different values of the mains voltage.

Figure 43 Example of additional P1 meter

You can also link all kinds of handy energy consumption managers to the smart meter. They can help you save energy. The smart meters have an open port (P1) which you can use to connect your own energy monitor. These products, connect to wifi and show the actual current energy consumption in an application. This way it is possible to monitor your own situation.

Thanks to the information from smart meters, network operators can work better on the future of our electricity network. This anonymous data allows them to see, for example, in which neighborhoods there are already many electric cars. The necessary reinforcement of the grid can therefore be done much more locally, instead of providing a large area with thicker cables. This saves the network operators and therefore the consumer a lot of costs.

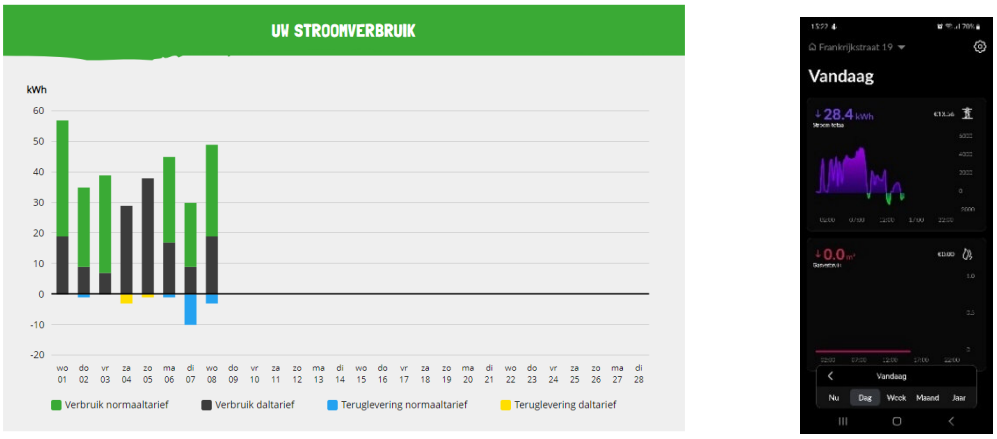


Figure 44 Example of energy monitoring provided by energy company(left) and report of additional monitoring (right)

The supply of electricity will fluctuate more, due to more and more solar and wind energy. One of the ways to deal with this is to adjust supply to demand. For example, you can give permission to run your washing machine when there is a large supply of electricity. Or you opt for an energy contract where the price depends on the supply at that time of the day (hourly contracts). To arrange all this technically, smart meters are needed. The government and network operators want everyone in the Netherlands to have a smart meter. That is why it costs nothing if the grid operator installs a smart meter.

GDPR in monitoring

There has been much discussion about the privacy aspects of a smart meter. If the meter can be read remotely, your usage data will go 'outside'. The data connection with the smart meter itself has been rigorously subjected to hack sensitivity testing by the Digital Security section of Radboud University. These tests showed that the connection is properly secured. The Consumers' Association does advocate 1 clear code of conduct for grid managers, energy suppliers and ODAs (offices registered to handle private data). These parties are independent service providers, such as the provider of a consumption manager. Currently, different codes of conduct apply to different parties. As a result, it is not easy to find out, for example, who is allowed to view data from the smart meter. And under what conditions.

You can connect an energy consumption manager to your smart meter to easily monitor your energy consumption. The connection is direct. Or indirectly, by giving permission to a third party. You then give permission to a specific ODA (independent service provider) to read your smart meter. You can then follow your consumption live via an app or website. You can revoke your permission to share. But this will also cause to terminate the information to yourself.

5.1.2 Sensi monitors

A. Sensi in save the homes

In the beginning of Save the Homes we would introduce the Sensi monitoring system. Although this is a monitoring system and it can be used to monitor temperature, energy use and indoor comfort before and after, its main goal was to get people aware of their energy use and indoor quality so they would start thinking about energy renovation. In Save the Homes, this awareness was already part of the activities of Alex Energy, and Sensi's did not add to that. Especially when combined with the (growing) insight of energy consumption, the added value was reduced. So to reach out to more people would require more devices, and the costs of maintaining them. Because the change in attitude towards energy consumption, the availability of free tools to monitor energy, and the pace of Alex Energy as lead partner in the neighborhood we decided not to use Sensi monitoring in Prins Alexander. With the introduction of Alex Energie the first point of contact was already made. Next to that the home owners of the first project already gathered information about the quality of their homes. Therefore it would not do any good to repeat this path.

In the upscaling in Pirns Alexander the amount of available Sensi's was too small (5 pieces) so not enough people could be reached. We will give an overview of the possibilities anyway, so follower cities can choose to put Sensi's (or similar) to use. Sensi's are also part of the toolbox that is provided in the Remodules project (Horizon No 955529).

B. Sensi's explained

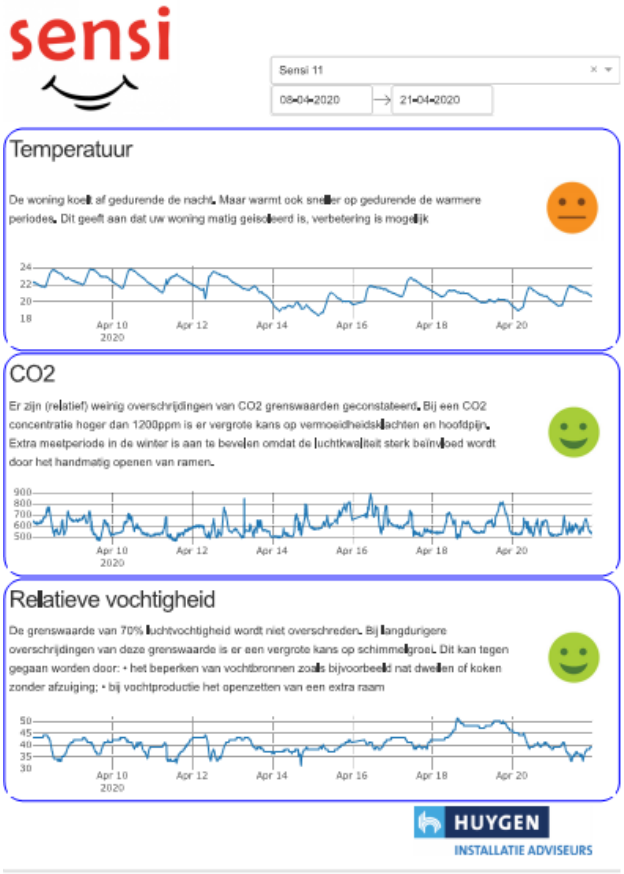
The Sensi Family was developed in collaboration between BouwhulpGroep, Alliantie+, Huygen Installatie Adviseurs and Durocan, as a way of informing residents about the current qualities of their homes by placing smart sensors in their home. The sensor collects data about energy consumption, living comfort and the health of the home. This data is later fed back to the resident in a final report so that they can start to make their homes more sustainable.

The idea of the Sensi started to take shape during a brainstorm session when it was concluded that the 'customer journey' of Alliantie+ (the Woning Paspoort) was an independent online 'journey' of the home-owner with no interference from other parties. This would be applicable for the monitoring as well, without any obstacles or barriers. This was also a way to improve the brand positioning. And from this idea the Sensi Family was born: a family traveling through the Netherlands and to raise awareness for sustainability of the living space among private home-owners. This is applicable for both awareness about the indoor climate as well as awareness for the structural construction of the house and the renovation possibilities. The Sensi's all have their own face, story and journey they take. The idea is based on the Dutch concept of the 'Logeerbeer': the logeerbeer is a teddy bear that a teacher would give to a child for a couple of days. The teddy bear is transported in a suitcase, in which there are toys, clothes and other stuff to play with. The parents of the child write in an accompanying

notebook the adventures of their child and the teddy bear. After a short period the bear would be brought back to school, to tell 'all it's adventures' and then go off to another child. This was also the aim of the Sensi, go to a house for a few weeks, let people see what was going on in their home concerning indoor climate and energy use and then go back. People were given a report of their situation with tips for improvement, for example renovation measures.

Sensi's were used in Triple A Reno as a means of raising awareness. This was also the aim of the Sensi's in Save the Homes. Residents do not need to be persuaded to participate in the research, by promoting the Sensi's as a free gadget.

It is quite hard to gather data about residents and their way of living. Residents usually have to be persuaded to work on a monitoring campaign together, by for example receiving a compensation. Research has shown that multiple factors influence residents and home-owners to either renovate or not. Not only financial factors play a large role in the decision, but health, comfort and wellbeing are often important motivations for residents in the final decision to renovate. The concept of the Sensi Family tries to help make that decision. By using the Sensi concept, residents are trying to be made more aware of the qualities of the indoor environment in their homes. The Sensi's measure temperature, humidity, CO_2 concentration and light intensity. At the same time the Sensi connects with the smart meter of the home. The resident has a personal login code with which the results of the Sensi can be viewed in a personal dashboard. The distinction between the good data and data that has room for improvement can be made in colors.



Next to this, an Instagram account was made for the Sensi Family to build a community and share stories about where the Sensi's have been and where they will go. Residents can also sign up here to be a host family for the Sensi. The host families can share photos of the Sensi in their homes. When a resident signs up for the Sensi, they give online permission to gather their data according to the AVG guidelines (monitoring information, smart meter data). After a period of four weeks the resident get the Woning Paspoort in combination with the monitoring report of the four weeks.

C. Technical details

The Sensi's are climate sensors that work via the LoRa network, by which real-time data can be clarified. This data is also saved in a database whereby they can be edited. LoRa is the specification for a telecommunications network and is suitable for long distance communication with as little power as possible. This means that sending data takes little to no energy, which results in a battery power of approximately ten years. In the Netherlands, KPN has a 99% coverage of the LoRa network. As a result of this network, the Sensi's send their data anyplace at all times. There is no installation or configuration needed and it is possible to send the Sensi's to host families through the post. If Sensi's would be used outside of the Netherlands it is good to check the coverage of LoRa.

The climate sensors that are used for this project measure temperature (+/- 0.2 °C), humidity (+/- 2%), CO_2 (+/- 50 ppm / 3% of reading), light (+/- 10 Lux) and movement (PIR). There is a connection with the smart meter in the home by means of available tooling when the barcode on the smart meter is known. By means of an API, this data is also visualized on the resident's dashboard and the data is written in the same database as the data from the climate sensors.

5.2 Implementation of the monitoring campaigns

The difference between the Netherlands and Spain is the technology that is already available. If we were to monitor in the same way that Valencia does, it would only add to the existing solutions and options and would add nothing new. Therefore, it would be much easier and better to ensure that the people who undertake a renovation give permission for the use of their energy bills before the renovation and after the renovation as in that way we can make a clear distinction between the current and new situation and take conclusions from it. As mentioned before, we do have the Sensi available in the Netherlands, but that is currently losing its (added) function. Another option to implement the monitoring campaign in an easy way is by the use of the app of the energy service that home owners are using.

Going into the meter cupboard with pen and paper every year to record the stand is no longer necessary thanks to the smart meter. This automatically transmits meter readings to the energy supplier. By downloading the accompanying app you will gain more insight into your energy consumption. The app shows in detail - sometimes even per hour or per device - how much gas and electricity is used. This way you know exactly where you can save. The apps are also called energy consumption manager. Each energy company has its own app, but there are also independent apps. The condition is therefore that you have a smart meter. But almost everyone has it. And every energy service has an app in which your energy usage can be tracked and compared.

5.2.1 Energy apps

An oversight of some (but not exclusive) of the available apps:

Figure 45 Example of energy consumption manager

Eneco app

In the Eneco app, customers stay informed of their consumption in a user-friendly manner. It is possible to adjust data, such as the installment amount, and to view all payments. The consumption is transparent per hour, day, week and month, as is the return supply of any solar panels.

Vattenfall app

The Vattenfall Energie app offers more or less the same as that of Eneco, namely tracking consumption and changing data. Users also receive a signal if the consumption costs are higher than normal and the app gives tips for saving.

Essent app

The Essent Consumption Manager+ can be used both online (via My Essent) and via the free app. The app gives advice on the monthly amount and shows the consumption per day, month or year. It also states what the return supply of solar panels is.

Oxxio app

The Oxxio app does more or less the same as the apps above. Users can read the consumption per hour, view invoices and change the monthly amount. There is also a paid version of the app: Oxxio Pro.

Greenchoice app

Greenchoice also has an app for customers to monitor consumption per month, day or hour. Just like the return delivery of solar panels. Find payments and annual invoices or change the monthly amount.

5.2.2 Independent energy apps

There are also apps that are not tied to an energy supplier. These are not free, for example the SlimmeMeterPortal.nl app costs 1.50 euros per month (price September 2022), while the service on the PC is free (after registration). The aim is that you register, get a better insight in your energy consumption, and it will be anonymously compared to other subscribers in your city. The 'MijnEnergieinzicht' service is also free to use, but does not have an app – although it does give that impression on the website. There are even more apps related to energy consumption on the site Energiegebruiksmanagers.nl. Some of these sites use the data provided by the grid operator. Others rely on a dongle that connects with an existing Wi-Fi signal.

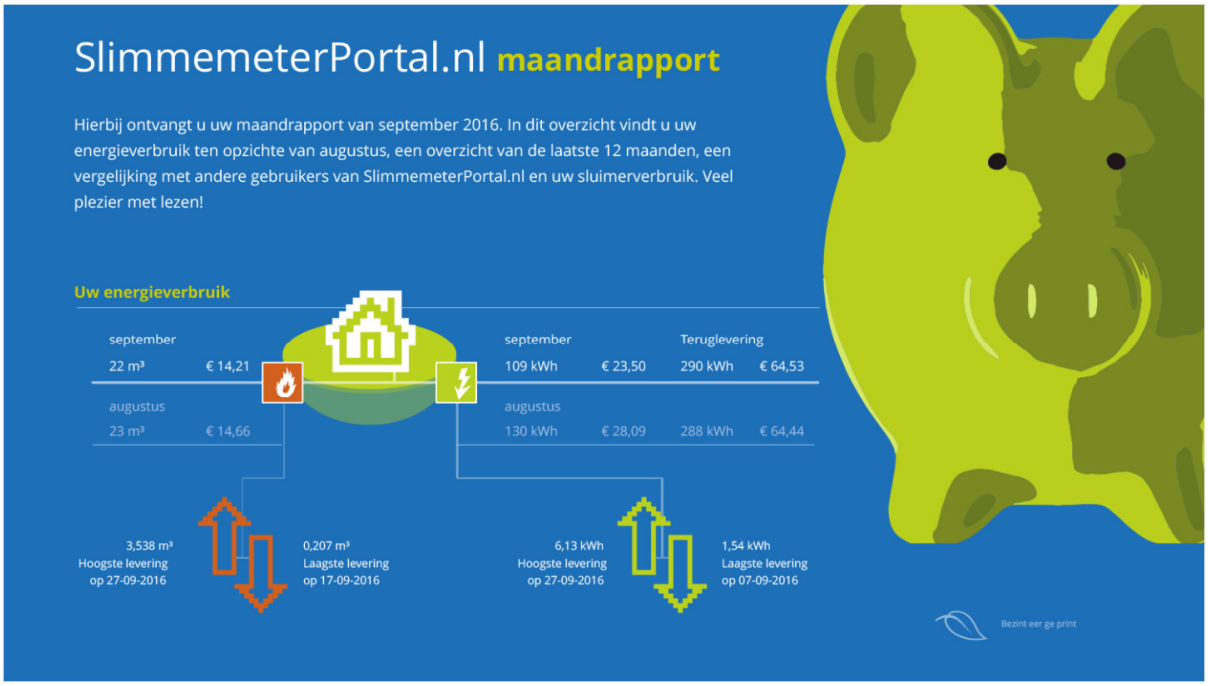


Figure 46 report of monthly energy consumption, provided by portal

5.3 Analysis of the monitoring campaigns results

In the case of Rotterdam, the first pilot started in an early stage with house visits (even in the onboarding phase). During these visits the energy bill was looked at and dissected by experts of Alex Energy. During early planning stage the energy consumption was the start of the measures and looked at in detail. The measures were explicitly aimed at reducing the individual het losses. This is a very time-consuming way to monitor energy performance.

In following phases people will be pointed towards energy monitoring to get a better view of their actual energy consumption. This will be part of the awareness campaigns. The tools and instruments described in 5.2 are all possible instrument to use.

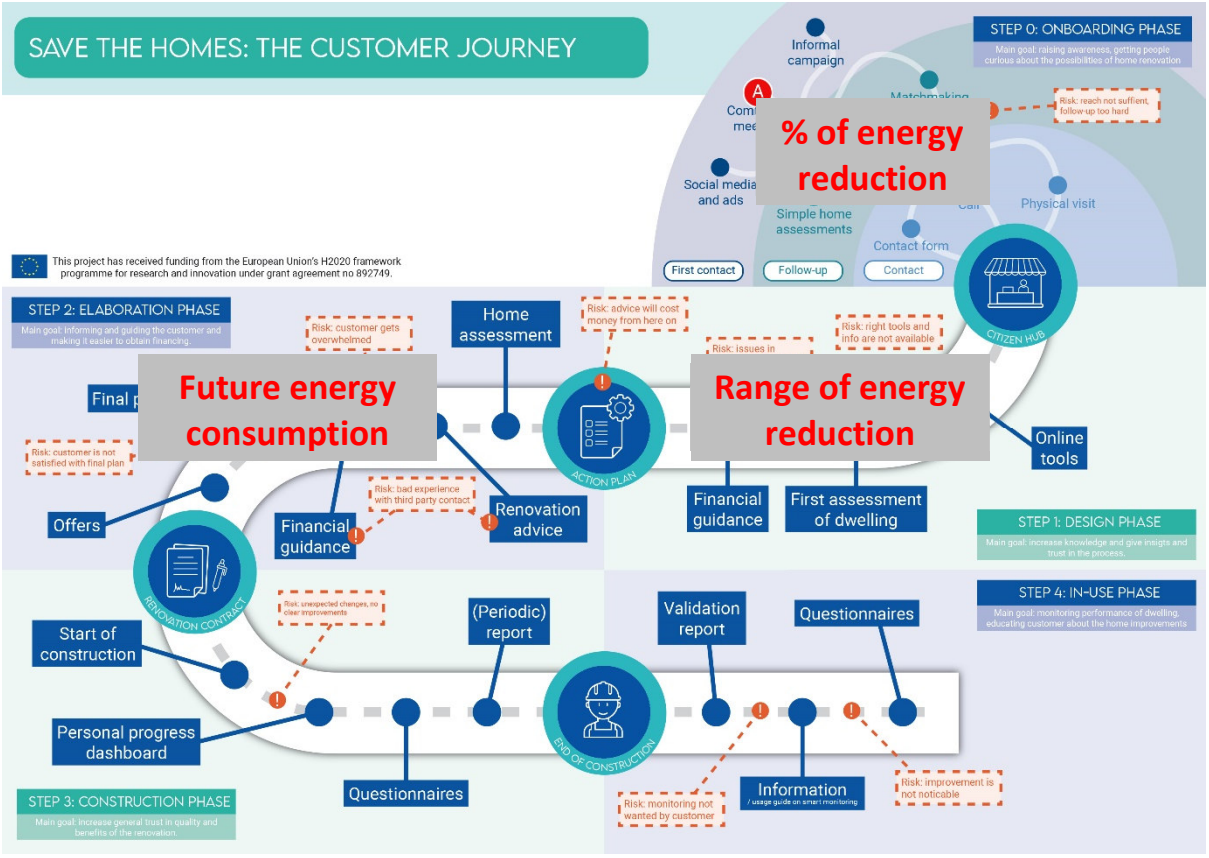


Figure 47.- communication on energy reduction in the customer journey

In the customer journey it would be good to give a first indication of possible energy reduction in the onboarding phase, for example a range of percentages. In the design phase this can be more a price, for example a range of reduction in m3 or kWh, perhaps transformed in euros, because that is what people care about. In the Elaboration phase it can be put in line with the current energy consumption, so a more elaborated view of your new energy consumption can be given. Because the pilot in Rotterdam was lead by people with profound knowledge on energy the three different levels of communication were already discussed in the first phases.

Now, at the end of Save the Homes, two pilot projects are finished/ongoing. In both cases communication with the participants was done by experts of Alex Energy. Each individual citizen chose his own set of measures. Some of them went of the natural gas, others did no go that far and kept their gas fired boiler. From the house visits some remarks can be derived on the overall energy performance in relation to the expected performance. For example, one building was not insulated all around, but still chose for a heat pump. This building now has troubles with reaching the desired temperature. This is a risk between advice and implementation. With proper energy monitoring (as described in the previous paragraph, a broader insight can be created on this level, to be more accurate in the future. This is also one of the lessons for the future, what are the right assumptions with these houses/ these situations.

The first pilot project aimed had a prognosis of 30% energy reduction. Initially they did not intend to place heat pumps. But due to the energy crisis and the war in Ukraine they changed the plan and six of them went for a heat pump. The average energy reduction reached 54%.

The second pilot 2 out of 6 buildings are off natural gas, and 4 deep renovations. They are almost finished, but the prognosis is that they will also reach an energy reduction higher than 50%.

After the two pilots the next step would be upscaling of deep renovations, aimed at 350 homes in the Bazelbuurt. Due to lack of workforce, this upscaling trajectory has never started. The plan was to use Ikwoon.io to inform people and use that app to form groups. From that point on, several groups (as much as needed to handle all the interest) would be formed. And in each group the energy performance would be point of discussion. In such a group the differences between people become clear and can partly be explained (occupancy, behaviour, large users). But when these indicators are known, they can be used in the expected energy consumption s well. But as already mentioned, this part did not start as planned. Instead, to react towards the citizens (and not doing anything) another track was chosen, instead of **ROUTE C: COLLECTIVE DEVELOPMENT OFFER-DEMAND,** a **ROUTE B: COLLECTIVE OFFER was** realised. This accounts for a much lower energy reduction (aimed was 30%), because instead of a deep renovation, just one or two individual measures were taken (i.e. installing PV or floor insulation). Of the 350 homes 55 household showed up and 33 chose for one or more measures (reaching a conversion rate of 10%). Ther are no definite numbers of the reduction in this case.

6 Follower cities

According to Objective 4 (To deliver real benefits to citizens and other stakeholders in two cities as a result of the Citizen Hubs operating locally), the objective is not only to provide the integrated renovation services to the specific homeowners groups identified in the two pilot cities (Rotterdam and Valencia) but also to demonstrate the potential of the Citizen Hub concept to all relevant stakeholders in other municipalities, to regain trust and interest in building renovations and to further expand the Citizen Hub business model.

In this context, and in order to roll out the Citizen Hub concept on a wider scale (regional, national and European), the Citizen Hub models developed for Valencia (ES) and Rotterdam (NL) will be one-on-one assessed with the two follower cities, Sant Cugat (ES) and Ljubljana (SI).

After defining the monitoring plan together with the cities of Valencia and Rotterdam during the implementation activities of WP4, a meeting to discuss them will be set-up with follower cities Sant Cugat and Ljubljana to find out current initiatives and lessons learned. With this in mind, both cities receive this draft methodology for building their Monitoring Plan (assisted by templates that can be found on the Annexes) and assess its applicability in their context.

After the implementation of the monitoring plan in the cities of Valencia and Rotterdam, it will be organized a meeting to discuss the results with follower cities Sant Cugat and Ljubljana. The objective is to share with them the lessons learned during the process and assess its applicability in their context.

Sant Cugat – ES

The objective is to test the replication in the same country for Spanish pilot in Valencia and follower city Sant Cugat. The aim is to analyse all the benefits of having the structure and services developed in national language and based on national circumstances, legislation, culture and habits.

Sant Cugat Municipality is assessing the methodology and feedback will be reported during WP4 and WP5 activities for pilot experiences and replication and exploitation activities.

Ljubljana – SI

The objective is to test the replication between EU countries where the Citizen Hub mapping methodology and results for the Dutch city of Rotterdam will be replicated for the City of Ljubljana in Slovenia. The aim is to validate the effectiveness of the replication process between the different EU countries.

The city of Ljubljana is assessing the methodology and feedback will be reported during WP4 and WP5 activities for pilot experiences and replication and exploitation activities

7 Conclusions

The evaluation of the monitoring campaign performed in the **Valencia pilot** shows that onboarding actions targeted and reached many citizens, in the form of events and publications, which, even if they consumed some time, worth the effort when compared to the average time dedicated to each potential user. Indeed, when comparing users reached, publications are the most effective. On the other hand, when comparing conversion rates, visits are the most successful. The negative side is the time required for some of the monitoring campaign actions, especially the site visits. This has two readings: on one hand, some actions (e.g., visits) consume too much time, so they do not worth it; but on the other hand, they throw high conversion rates and help to validate or improve the customer journey and explain the benefits of the renovation and drawn attention to its bottlenecks or problems. As a conclusion, a higher level of automatization in the monitoring activities could allow for repeating these campaigns at least once a year, so renew success stories and best practices, and re-evaluate the services offered by the OSS.

Regarding the data collection, when the data successfully collected is analysed, it can be concluded that data collection that relies solely on the technician is easier to collect than data that relies on the occupant. This is clearly shown in the energy measurements. Since the procedure required the owner's intervention (homeowners had to provide documents and register online), we still do not have some of them. In some cases, the problem was due to difficulties with the website or app (people with low technological skills) and in other cases the problem was due to a lack of interest on the part of the owners.

Finally, the direct contact with the occupants of the monitored dwellings (who are the potential users of the customer journey) allowed to draw some conclusions to be implemented in the OSS: awareness and/or specific training of all the customer journey stakeholders (users, technicians, property managers, neighbours' community, etc,) is key to provide updated, objective, and truthful information. On the other hand, providing users with a rental service of self-use monitoring tools can improve user's engagement and boost renovations processes.

In the case of **Rotterdam pilot**, the first pilot case started in an early stage with house visits, where the energy bills were looked at and dissected. During early planning stage the energy consumption was the start of the measures, it was looked at in detail, and the measures were explicitly aimed at reducing the individual het losses. The conclusion was that this is a very time-consuming way to monitor energy performance. Therefore, it was concluded that it would be much easier and better to ensure that the people who undertake a renovation give permission for the use of the data from the smart meters using the app of the energy service before the renovation and after the renovation as in that way we can make a clear distinction between the current and new situation and take conclusions from it. Besides, in following phases people will be pointed towards energy monitoring to get a better view of their actual energy consumption. This will be part of the awareness campaigns.

Annex 1 – Benefits Monitoring templates

- **Building description:**

Hoja1 Tab (themes and variables):

Location	Building	Dwelling	Data
reg	buildinguse	floor	energyconsumptionkwhm2yrfrombills
country	buildingtypology	numberletter	energycertificate
building	buildingform	orientation1	primaryenergyconsumptionkwhm2yrfromcertificate
unit	market	orientation2	whopaysforenergy
region	b_height	refurbishmentsyear	mainnonres
city	year	u_area	mainres
climatezone	b_area	u_height	heatingcontrol
	b_numberofoccupants	numberoffloors	coolingcontrol
	numberofresidencialunits	u_numberofoccupants	windows
		userprofile	shadowing
			heatingsystem
			coolingsystem
			asymmetry
			shadowingsystem
			respercentage
			resproductionkwhm2y

Location Tab:

reg	country	building	unit	region	city	climatezone
int	*select*	*int*	*int*	*string*	*string*	*select*

Building Tab:

Reg	Building	buildinguse	buildingtypology	buildingform	market	b_height	year	b_area	b_numberofoccupants	numberofresidencialunits
from Location	*int*	*select*	*select*	*select*	*select*	*select*	*int*	*int*	*int*	*int*

Dwelling Tab:

Building	Dwelling	floor	numberletter	orientation1	orientation2	refurbishmentsyear	u_area	u_height	numberoffloors	u_numberofoccupants	userprofile
from building	*int*	*int*	*string*	*select*	*select*	*int*	*int*	*double*	*int*	*int*	*select*

Other data Tab:

Dwelling	Data	energyconsumptionkwhm2yrfrombills	energycertificate	primaryenergyconsumptionkwhm2yrfromcertificate	whopaysforenergy	mainnonres	mainres	heatingcontrol
From Dwelling	*int*	*int*	*select*	*int*	*select*	*select*	*select*	*select*

coolingcontrol	windows	shadowing	heatingsystem	coolingsystem	asymmetry	shadowingsystem	respercentage	resproductionkwhm2y
select	*select*	*select*	*select*	*select*	*select*	*select*	*int*	*int*

- **Monitoring data description**

Hoja1 Tab (themes and variables):

reg	country	building	unit	season	phase	family	variable	timestamp	value
from alldes	*from alldes*	*from alldes*	*from alldes*	Winter	Ante	Energy	Home energy consumption		
				Summer	Post	IndoorEQ	CO2		
						Wellbeing	Air Temperature		
							Relative humididty		
							Illuminance level		
							TVOC		
							Formaldehydes		
							PM2.5		
							PM10		
							Activity		
							Clothing		
							Stressors-		
							Symptoms-		
							Thermal comfort		

Measurements Tab (description):

unit	measurement	season	phase	family	variable
from Dwelling	*int*	*select*	*select*	*select*	*select*

Values Tab (data collection):

measurement	timestamp	value
int	*timestamp*	*double/ string*

Variables Tab:

season	phase	family	variable
Winter	Ante	**Energy**	**Home energy consumption**
Summer	Post	**IndoorEQ**	**CO2**
		Wellbeing	**Air Temperature**
			Relative humididty
			Illuminance level
			TVOC
			Formaldehydes
			PM2.5
			PM10
			Activity
			Clothing
			Stressors-
			Symptoms-
			Thermal comfort

Annex 2 – Best practices map deployment plan

Based on the benefits monitoring data, 'best practices' map deployment plan for the Spanish case is based on a twofold approach. On one hand, automatic data coming from public/ open data sources:

Data	Unit	Source	Priority	Notes
DWELLING DATA			-	
Cadastral reference	-	IEE/CAT	1	IEE: 14 Digits CAT: 20 Digits CEE. 20 Digits
Year of construction	-	IEE	1	In CAT it is also available but it is changes when it appears a renovation
Current regulation	-	CEE	2	
Nº Floors	-	IEE/CAT	2	
Nº Dwellings	-	IEE	2	
Listed building	-	IEE	2	
Building typology	-	IEE/CAT/CEE	1	IEE*: PB2, PB3, PM2, PM3, UA2, UA3, UH2, UH3 CAT: 111 open building, 112 closed block, 121 single family homes, 122 terrace houses, 131 rural house CEE: Individual dwelling, single family home, Residential building (whole block). *CEE does not indicate if it open building or closed block.
Case typology	-	IEE/CEE	1	Individual dwelling, single family home, Residential Building (whole block) IEE are always Residential Building (whole block) CEE can be Individual dwelling, single family home, Residential Building (whole block)
Address	-	CEE	1	Is it available in CAT and IEE?
Type of renovation	-	CAT	2	R: Integral renovation O: Total renovation E: Medium renovation I: Minimum renovation
Year of renovation	-	CAT	2	
Surface	m2	CAT	2	
Cadastral category	-	CAT	2	1 excellent - 9 bad
Cadastral photograph	-	CAT	1	
Before and after photographs	-	GOO	2	
RENOVATION INDICATORS			-	
Pre-renovation state				
Energy certification date	-	IEE/CEE	1	
Link to EPC	-	CEE	2	
Energy needs				
Heating energy demand	kWh/m2year	IEE	2	
Cooling energy demand	kWh/m2year	IEE	2	
Energy use				
Overall non-renewable primary energy use	kWh/m2year	IEE/CEE	1	
__Domestic hot water non-renewable primary energy use	kWh/m2year	IEE	2	
__Heating non-renewable primary energy use	kWh/m2year	IEE	2	
__Cooling non-renewable primary energy use	kWh/m2year	IEE	2	
Energy efficiency rating	-	IEE/CEE	1	Not available before 2018
Carbon dioxide emissions				
Overall carbon dioxide emissions	kgCO2/m2year	IEE	1	
__Domestic hot water carbon dioxide emissions	kgCO2/m2year	IEE	2	
__Heating carbon dioxide emissions	kgCO2/m2year	IEE	2	
__Cooling carbon dioxide emissions	kgCO2/m2year	IEE	2	
Environmental impact (CO2) rating	-	IEE/CEE	1	
Post-renovation state				
Energy certification date	-	IEE/CEE	1	
Link to EPC	-	CEE	2	
Energy needs				
Heating energy demand	kWh/m2year	IEE	2	
Cooling energy demand	kWh/m2year	IEE	2	
Energy use				
Overall non-renewable primary energy use	kWh/m2year	IEE/CEE	1	
__Domestic hot water non-renewable primary energy use	kWh/m2year	IEE	2	
__Heating non-renewable primary energy use	kWh/m2year	IEE	2	
__Cooling non-renewable primary energy use	kWh/m2year	IEE	2	
Energy efficiency rating	-	IEE/CEE	1	Not available before 2018
Carbon dioxide emissions				
Overall carbon dioxide emissions	kgCO2/m2year	IEE	1	
__Domestic hot water carbon dioxide emissions	kgCO2/m2year	IEE	2	
__Heating carbon dioxide emissions	kgCO2/m2year	IEE	2	
__Cooling carbon dioxide emissions	kgCO2/m2year	IEE	2	
Environmental impact (CO2) rating	-	IEE/CEE	1	

Figure 48.- Automatic data for benefits monitoring map

Where:

- IEE is Building Evaluation Report
- CAT is Cadastral database
- CEE is Energy Performance Certificate
- GOO is Google Street view

On the other hand, data introduced by the user:

Data	Unit	Options	Notes
RENOVATION INFORMATION			
MEASURES			
Envelope improvement: Thermal insulation	-	yes/no	
Envelope improvement: Windows replacement	-	yes/no	
Systems replacement: Aerothermal for heating, cooling and DHW	-	yes/no	
Systems replacement: Aerothermal for DHW	-	yes/no	
Energy production: photovoltaic panels	-	yes/no	
Description	-		Description of the intervention
ECONOMIC COST			
Total cost (whole building)	€		
Total cost (per dwelling)	€		
Total cost per m2 per dwelling	€		
Received grant (whole building)	€		
Received grant (whole building) - percentage	%		
Received grant (per dwelling)	€		
Monthly cost/per dwelling/24 months (inc. grants)	€		
Estimated Next Generation grant (whole building)	€		
Estimated Next Generation grant (whole building) - percentage	%		
Estimated Next Generation grant (per dwelling)	€		
Estimated Next Generation monthly cost/per dwelling/24 months	€		
OTHERS			
Photographs	-		Photographs of the renovated state, detail of rehabilitation elements (windows, photovoltaic...)
COMBINED PERFORMANCE LABEL ON ENERGY, IEQ AND WELL-BEING			
ENERGY INDICATOR			
Energy Class	-	Align with national energy performance certification (EPBD)	
Calculated total primary energy use	kWh/m²a	Align with EN 15603 and EN ISO 13790, or EN ISO 52000 standard series	
Calculated delivered energy use	kWh/m²a	Align with EN 15603 and EN ISO 13790, or EN ISO 52000 standard series	
__Calculated delivered energy use (fuel)	kWh/m²a	Align with EN 15603 and EN ISO 13790, or EN ISO 52000 standard series	
__Calculated delivered energy use (electricity)	kWh/m²a	Align with EN 15603 and EN ISO 13790, or EN ISO 52000 standard series	
__Calculated delivered energy use (district energy)	kWh/m²a	Sum of all calculated delivered energy use	
Measured delivered energy use	kWh/m²a	Based on measurement or energy bills. Energy consumption without any correction	
__Measured delivered energy use (fuel)	kWh/m²a	Based on measurement or energy bills. Energy consumption without any correction	
__Measured delivered energy use (electricity)	kWh/m²a	Based on measurement or energy bills. Energy consumption without any correction	
__Measured delivered energy use (district energy)	kWh/m²a	Sum of all measured energy use	
Share of RES	%	Renewable primary energy use divided by total primary energy use	
Area weighted average thermal transmittance	W/m2K	Regarding above ground structures. Uavr = ∑Ai*Ui / ∑Ai	

Figure 49.- Manual data for benefits monitoring map (I - input)

Data	Unit	Options	Notes
RENOVATION INFORMATION			
COMBINED PERFORMANCE LABEL ON ENERGY, IEQ AND WELL-BEING			
ENERGY INDICATOR			
WELL-BEING AND IEQ			
QUALITY WELL-BEING AND IEQ			
Control of heating system	-	No heating system No control Central (building) temperature control Apartment temperature control Room temperature control	
Control of cooling system	-	No cooling system No control Central (building) temperature control Apartment temperature control Room temperature control	
Fresh air Flow (mechanical ventilation) per number of occupants	l/s	No mechanical ventilation EN 16798-1 category I or category II EN 16798-1 category III Less than EN 16798-1 category III	
Air tightness of windors and doors	-	Poor air-tightness: warped, poorly fitted or unsealed windows and doors. Medium air-tightness: windows and doors with well fitted sealings. Good air-tightness: factory-fitted shaped sealing profiles or certification document according to EN 12207 Class 4.	
Exterior shading in windows from East to west	%	100% 90-99% 80-89% 70-79% 60-69% 50-59% 40-49% 30-39% 20-29% 10-19% 0-9%	
Radiant heating and/or cooling system	%	≥ 50% of the conditioned floor area < 50% of the conditioned floor area	
Radiant temperatura asymetry	-	ISO 7730:2005 Category A or B ISO 7730:2005 Category C or worst	
MEASURED WELL-BEING AND IEQ INDICATOR			
Operative temperature – heating season	°C	No heating system No measurement EN 16798-1 Category II EN 16798-1 Category III EN 16798-1 Category IV or worst	- Selection of the category: 85% of the measured values shall meet the selected category.
Operative temperature – cooling season	°C	No cooling system No measurement EN 16798-1 Category II EN 16798-1 Category III EN 16798-1 Category IV or worst	- Selection of the category: 85% of the measured values shall meet the selected category.
Relative humidity of indoor air is between 30 % and 70 %	%	No measurement 30% ≤ RH ≤ 70% RH < 30% or RH > 70%	- Selection of the category: 85% of the measured values shall meet the selected category.
CO_2 concentration	ppm	No measurement EN 16798-1 Category II EN 16798-1 Category III EN 16798-1 Category IV or worst	- Selection of the category: 85% of the measured values shall meet the selected category.
TVOC	µg/m³	No measurement TVOC < 500 µg/m³ TVOC ≥ 500 µg/m³	- Selection of the category: 85% of the measured values shall meet the selected category.
Formaldehyde	ppb	No measurement Formaldehyde < 100 µg/m³ Formaldehyde ≥ 100 µg/m³	- Selection of the category: 85% of the measured values shall meet the selected category.
PM2,5	µg/m³	No measurement PM2.5 < 15 µg/m³ PM2.5 ≥ 15 µg/m³	- Selection of the category: 85% of the measured values shall meet the selected category.
PM10	µg/m³	No measurement PM10 < 50 µg/m³ PM10 ≥ 50 µg/m³	- Selection of the category: 85% of the measured values shall meet the selected category.

Figure 50.- Manual data for benefits monitoring map (II - selection)

Data	Unit	Options	Notes
RENOVATION INFORMATION			
COMBINED PERFORMANCE LABEL ON ENERGY, IEQ AND WELL-BEING			
MONITORING BENEFITS OF RENOVATION			
Air temperature	ºC	Priority 1	
Globe temperature	ºC	Priority 2	
Relative temperature	%	Priority 1	
Air Velocity	m/s	Priority 2	
CO2	ppm	Priority 1	
TVOCs	µg/m³	Priority 2	
Delivered energy demand	W/h	Priority 2	It can be provided by bills

Figure 51.- Manual data for benefits monitoring map (III - upload)

Then web map service will show, for each location, a pin. When click in the pin, a pop-up will show the summary data (coming from the automatic dataset):

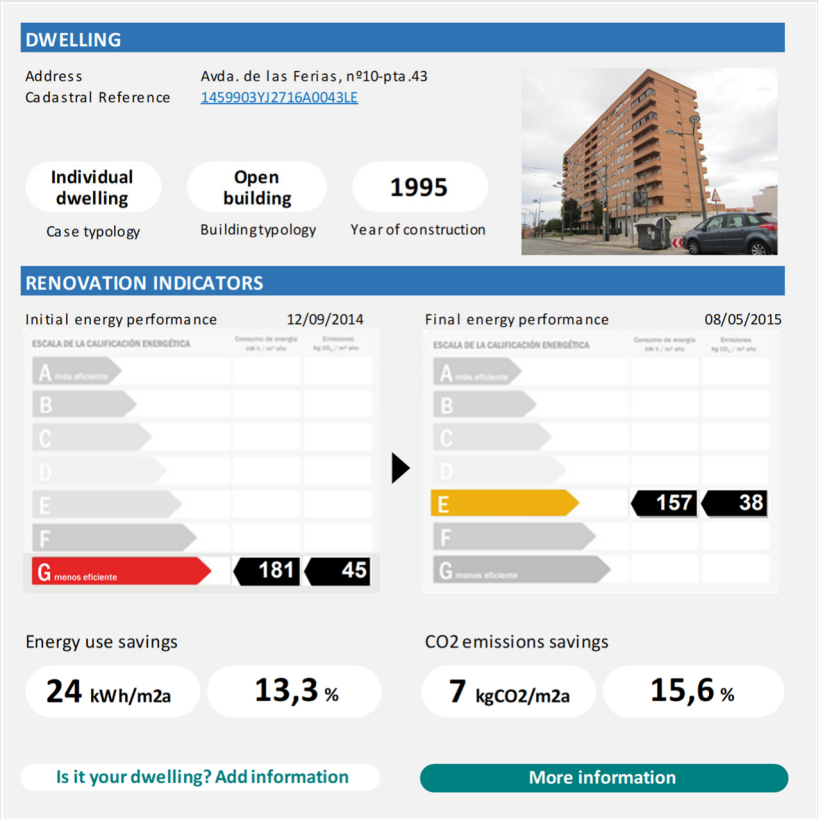


Figure 52.- Best practice pop-up information mock-up

If the user wants to update the best practice case and add the manual information, they can do it directly on the web map, by clicking on the 'Add Information' button. If the information is already input, when clicking the 'More Information' button, the user will be shown a set of structured information in several tabs:

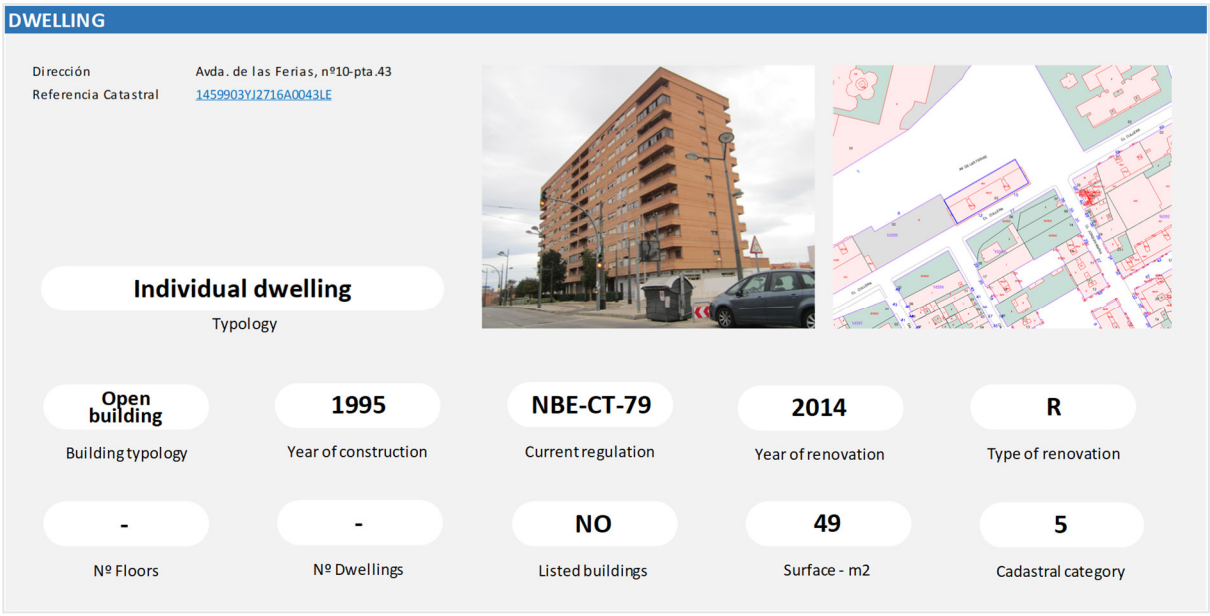


Figure 53.- Best practice case building/dwelling information

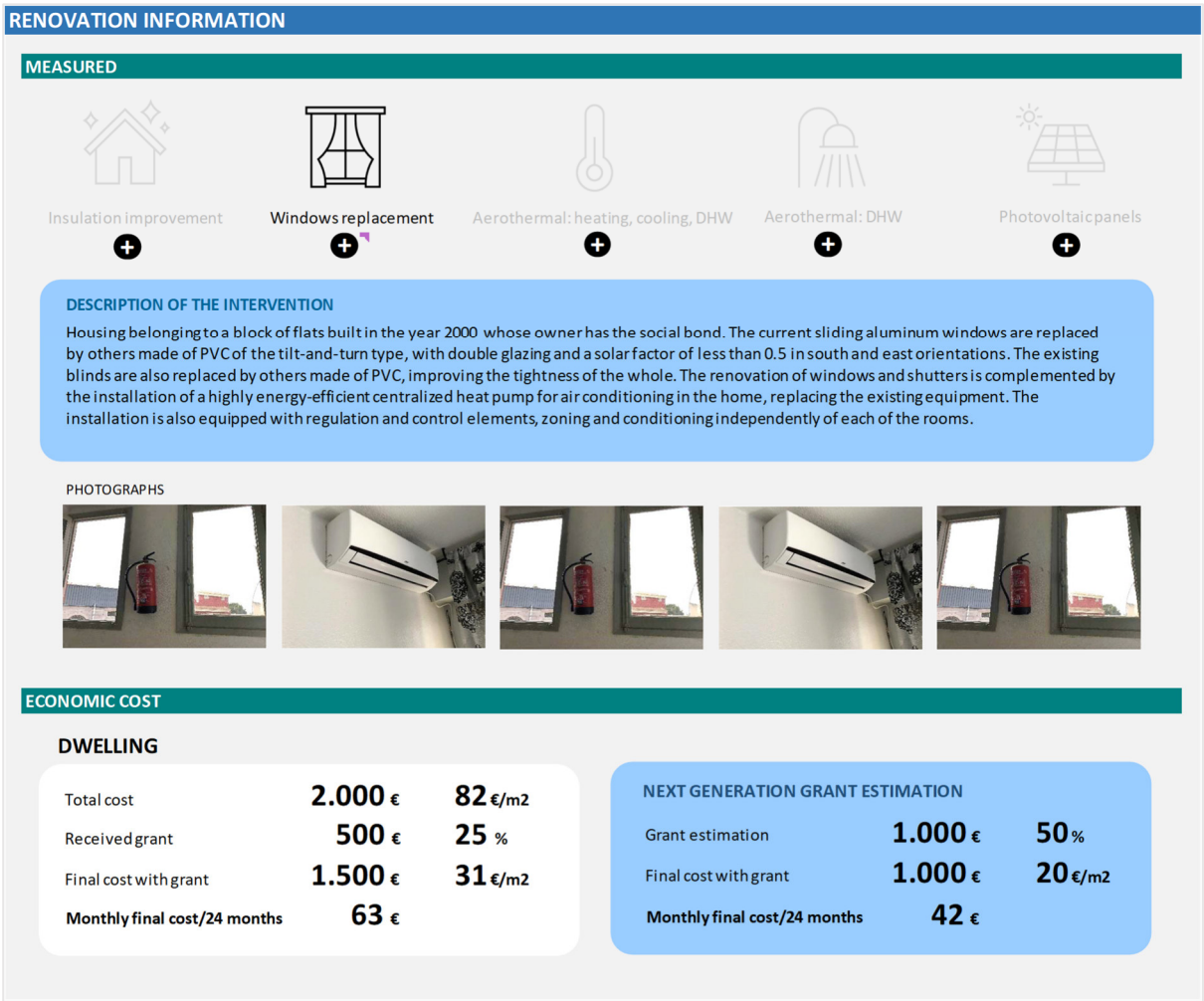


Figure 54.- Best practice case renovation information (if one dwelling)

Figure 55.- Best practice case renovation information (if whole building)

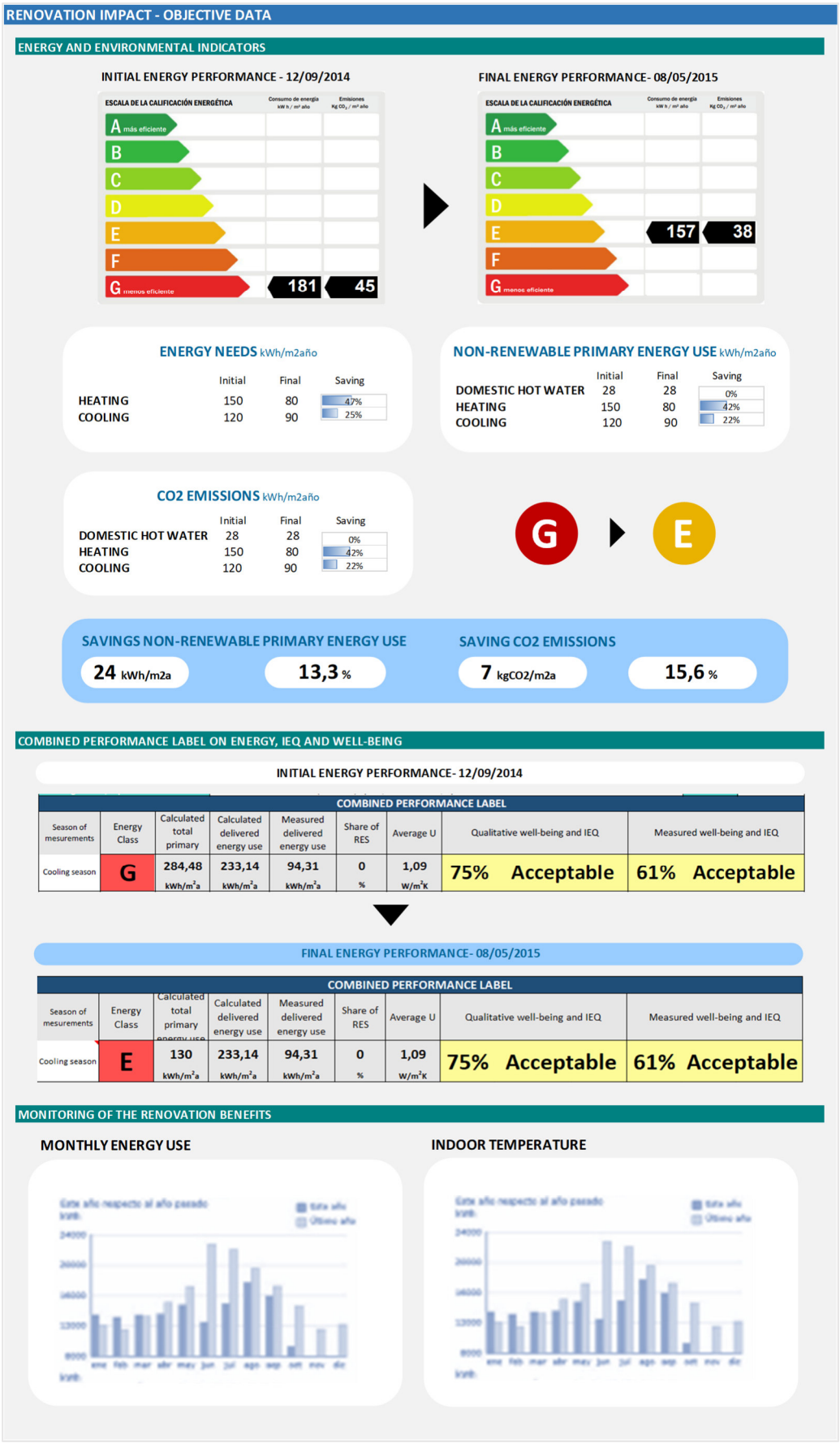


Figure 56.- Best practice case impact information (measurable data)

As a complement, the success story can also be uploaded and shared with the users community:

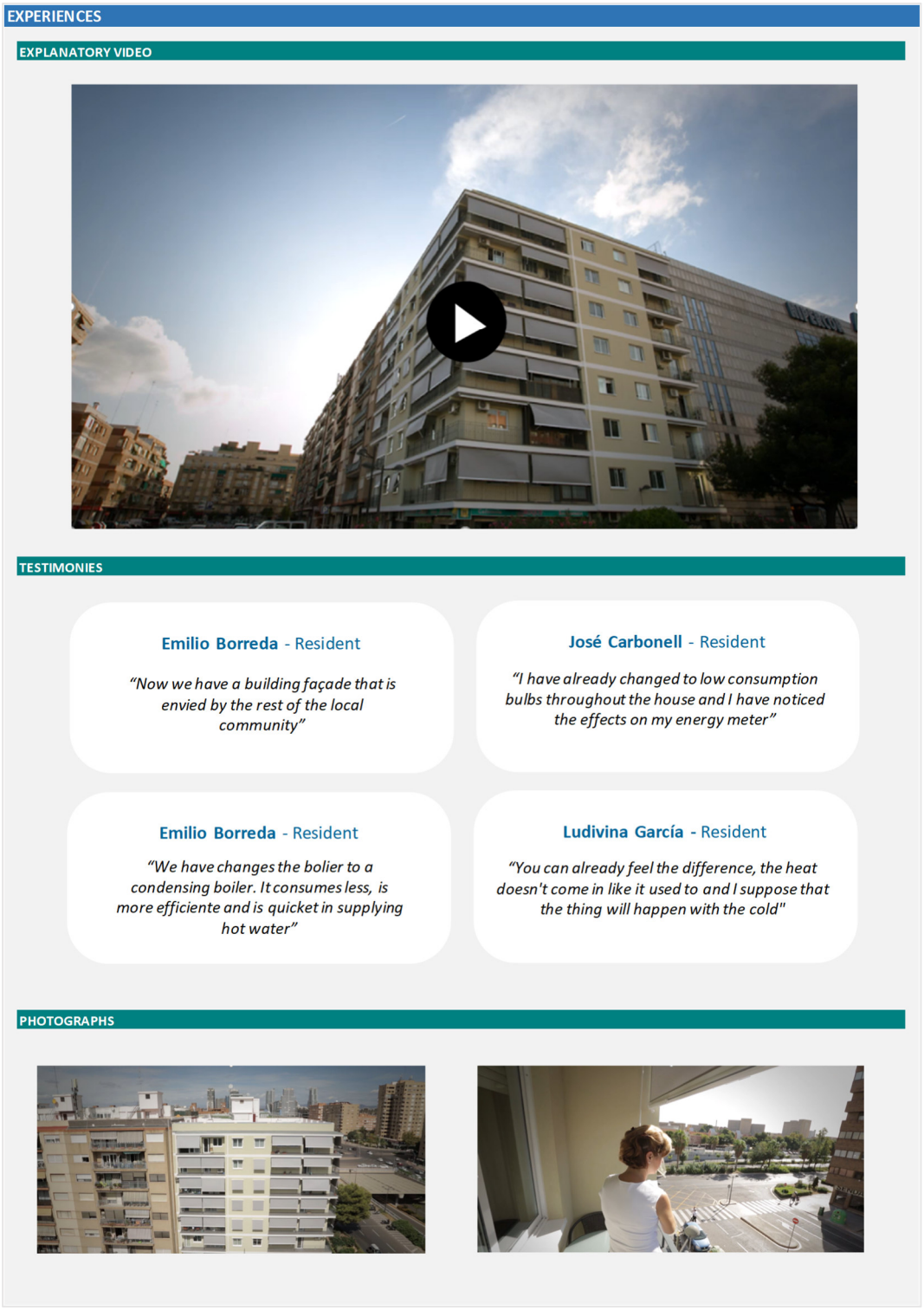
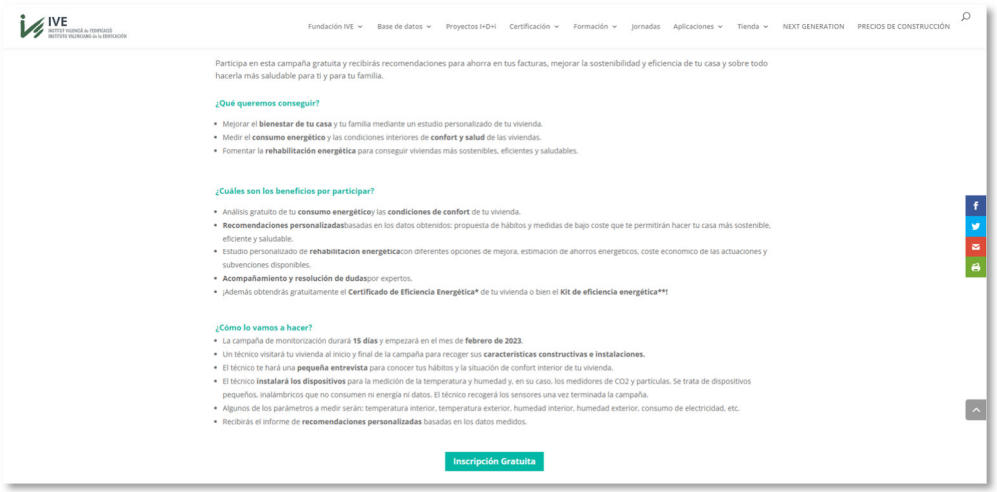
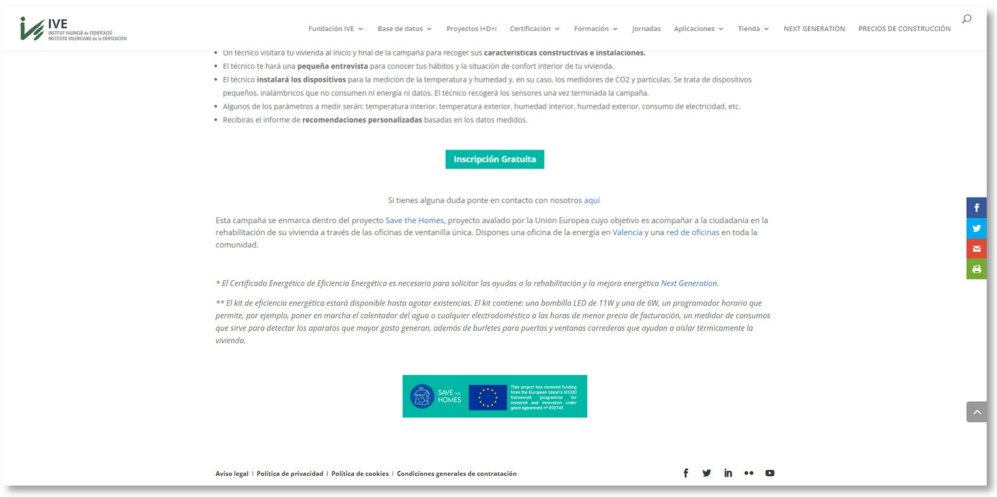


Figure 57.- Best practice case impact information (perceived data)

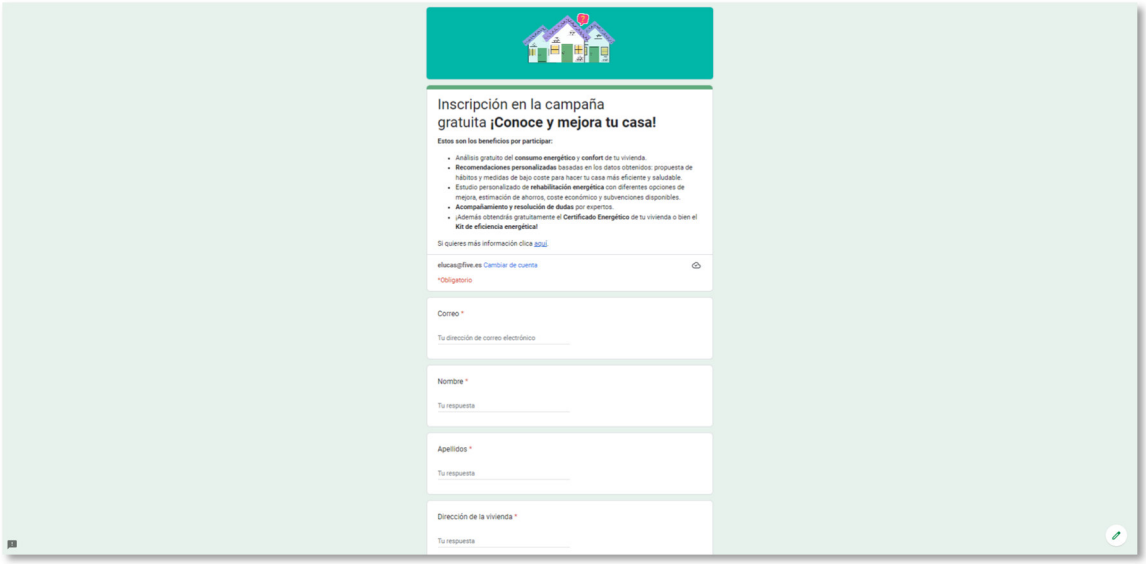
Annex 3 – Documents prepared to collect participants for the monitoring campaign.

- Landing page with the monitoring campaign information and link to the free registration





- Registration form to participate in the monitoring campaign



Inscripción en la campaña gratuita **¡Conoce y mejora tu casa!**

Estos son los beneficios por participar:

- Análisis gratuito del **consumo energético** y **confort** de tu vivienda.
- **Recomendaciones personalizadas** basadas en los datos obtenidos: propuesta de hábitos y medidas de bajo coste para hacer tu casa más eficiente y saludable.
- Estudio personalizado de **rehabilitación energética** con diferentes opciones de mejora, estimación de ahorros, coste económico y subvenciones disponibles.
- **Acompañamiento y resolución de dudas** por expertos.
- ¡Además obtendrás gratuitamente el **Certificado Energético** de tu vivienda o bien el **Kit de eficiencia energética!**

Si quieres más información clica aquí

elucas@five.es Cambiar de cuenta

*Obligatorio

Correo *

Tu dirección de correo electrónico

Nombre *

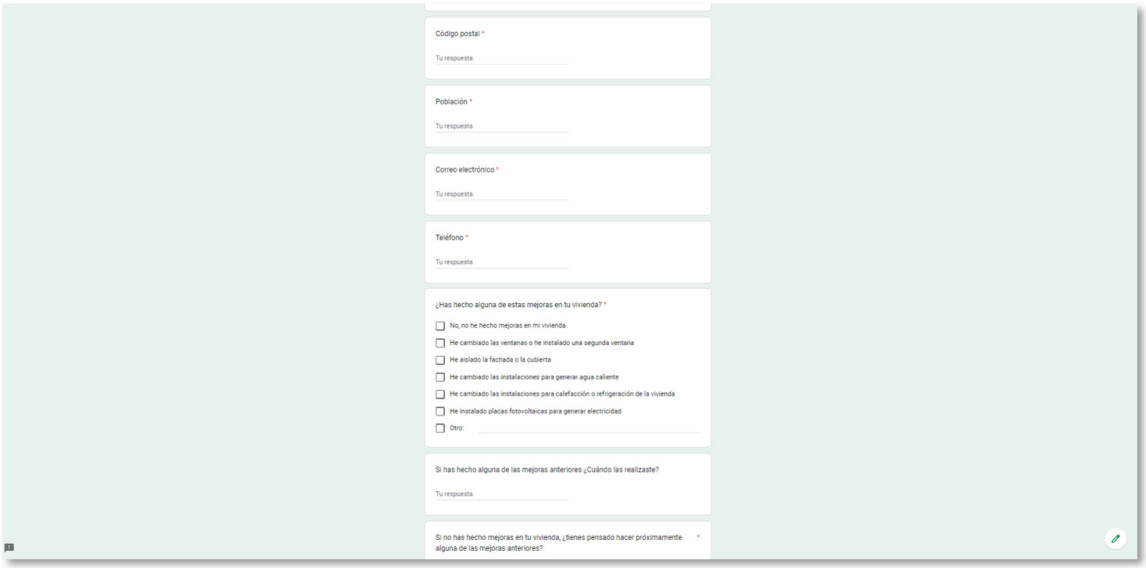
Tu respuesta

Apellidos *

Tu respuesta

Dirección de la vivienda *

Tu respuesta



Código postal *

Tu respuesta

Población *

Tu respuesta

Correo electrónico *

Tu respuesta

Teléfono *

Tu respuesta

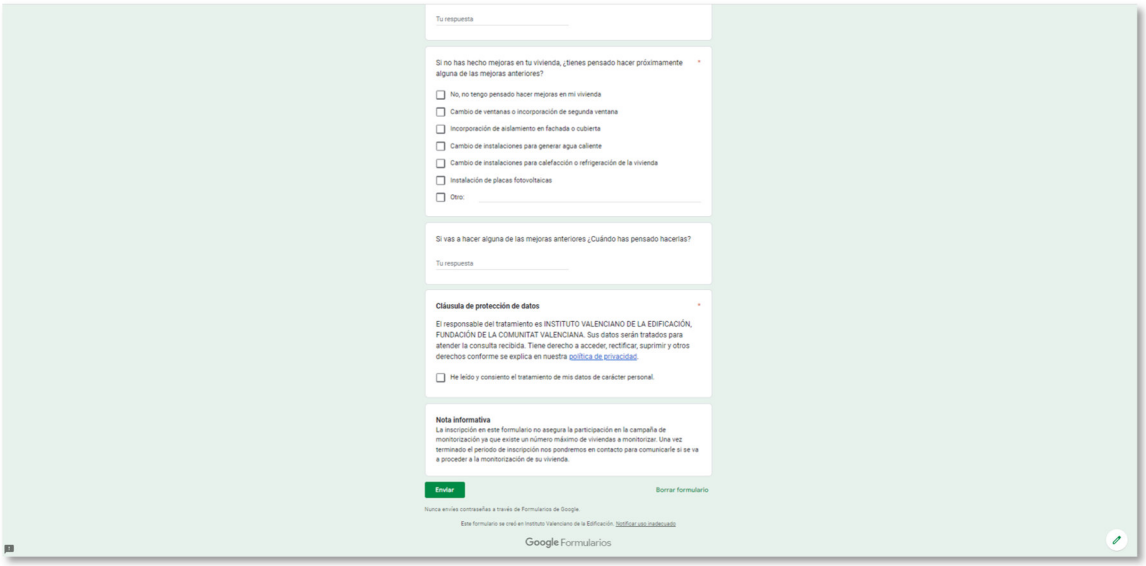
¿Has hecho alguna de estas mejoras en tu vivienda? *

- [ ] No, no he hecho mejoras en mi vivienda
- [ ] He cambiado las ventanas o he instalado una segunda ventana
- [ ] He aislado la fachada o la cubierta
- [ ] He cambiado las instalaciones para generar agua caliente
- [ ] He cambiado las instalaciones para calefacción o refrigeración de la vivienda
- [ ] He instalado placas fotovoltaicas para generar electricidad
- [ ] Otro:

Si has hecho alguna de las mejoras anteriores ¿Cuándo las realizaste?

Tu respuesta

Si no has hecho mejoras en tu vivienda, ¿tienes pensado hacer próximamente alguna de las mejoras anteriores? *



Tu respuesta

Si no has hecho mejoras en tu vivienda, ¿tienes pensado hacer próximamente alguna de las mejoras anteriores? *

- [ ] No, no tengo pensado hacer mejoras en mi vivienda
- [ ] Cambio de ventanas o incorporación de segunda ventana
- [ ] Incorporación de aislamiento en fachada o cubierta
- [ ] Cambio de instalaciones para generar agua caliente
- [ ] Cambio de instalaciones para calefacción o refrigeración de la vivienda
- [ ] Instalación de placas fotovoltaicas
- [ ] Otro:

Si vas a hacer alguna de las mejoras anteriores ¿Cuándo has pensado hacerlas?

Tu respuesta

Cláusula de protección de datos *

El responsable del tratamiento es INSTITUTO VALENCIANO DE LA EDIFICACIÓN, FUNDACIÓN DE LA COMUNITAT VALENCIANA. Sus datos serán tratados para atender la consulta recibida. Tiene derecho a acceder, rectificar, suprimir y otros derechos conforme se explica en nuestra política de privacidad.

- [ ] He leído y consiento el tratamiento de mis datos de carácter personal.

Nota informativa

La inscripción en este formulario no asegura la participación en la campaña de monitorización ya que existe un número máximo de viviendas a monitorizar. Una vez terminado el periodo de inscripción nos pondremos en contacto para comunicarle si se va a proceder a la monitorización de su vivienda.

Enviar

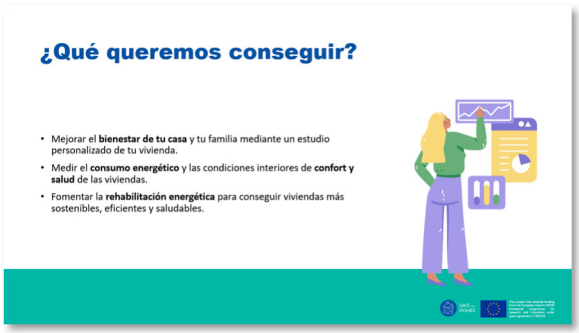
Borrar formulario

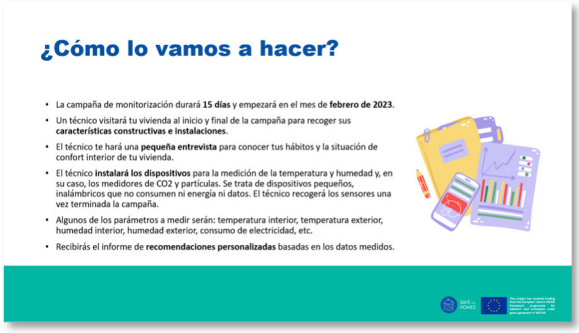
Nunca envíes contraseñas a través de Formularios de Google.

Este formulario se creó en Instituto Valenciano de la Edificación. Notificar uso inadecuado

Google Formularios

- Presentation prepared to be shared in the energy offices activities





Annex 4 – Report for the optimization of the electricity tariff.

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Tu informe de eficiencia

Hola,
David
1 46023, (VALENCIA)

Resumen de costes

Coste por energía consumida	747,40 €
Coste por potencia contratada	156,39 €
Coste por exceso de potencia	0,00 €
Coste por energía reactiva	0,00 €
Impuesto eléctrico 0,5%	4,52 €
IVA 5% (sobre 908,30 €)	45,42 €
Coste total anual (con IVA):	**953,72 €**

Cups

Tarifa
2.0 TD

Potencia contratada
P1 5,0 kW - P2 5,0 kW

Periodo análisis
24/10/2021 - 23/10/2022

Fecha informe
17/11/2022

¡Estás pagando de media la energía a ...!

Durante el periodo del análisis del informe, en base a tus consumos por periodos, has pagado la **energía de media a 0,32 €/kWh**

Puedes AHORRAR hasta ...

46,20 € al año

Sigue leyendo! Te lo explicamos en base a tus datos **reales**
#DejaQueTusDatosDecidanPorTi

València Clima i Energia · Oficina de l'Energia

¿Cómo ahorrar en tu factura?

Ajusta tus potencias contratadas

Tras analizar los maxímetros reales registrados por tu contador, podemos sugerirte un ajuste de potencias que te permitirá un potencial ahorro de 46 € cada año

	P1	P2
Contratada	4,95	4,95
Demandada	3,47	3,32
Óptima	3,50	4,95

Tus potencias actuales
P1: 4,95kW P2: 4,95kW
Tus potencias sugeridas
P1: 3,50kW P2: 4,95kW*

*Ajustar potencia en P2 no aporta gran ahorro, se podría mantener la potencia contratada actual en P2, y aprovechar para trasladar consumos instantáneos al fin de semana.

+ Información

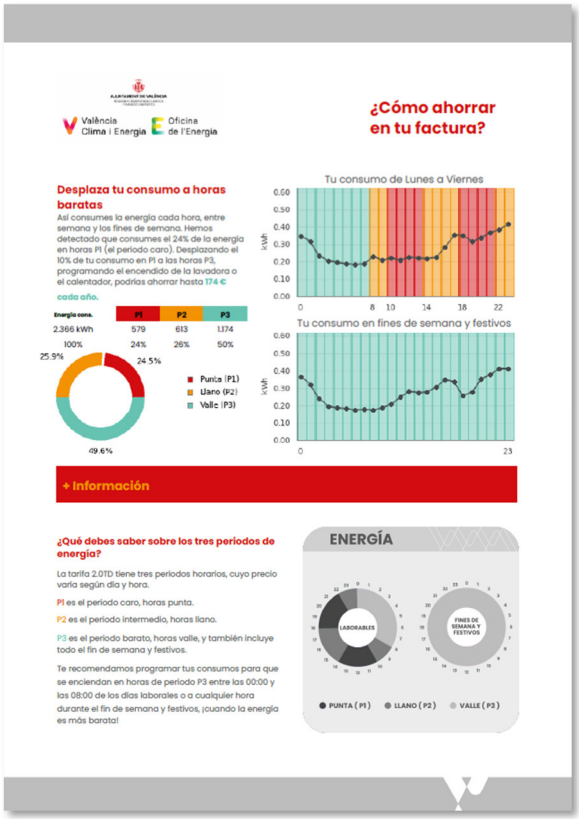
¿Qué debes saber sobre las dos potencias contratadas?

La tarifa 2.0TD tiene dos potencias contratadas, cuyo precio varía entre dos periodos según las horas y los días de la semana.

P1 es el periodo caro, horas punta, y corresponde a la potencia contratada P1.

P2 el periodo barato, horas valle, y corresponde a la potencia contratada P2. Incluye los fines de semana y festivos.

Recomendamos ajustar la potencia en P1 (por el gran ahorro) y mantener la potencia contratada en P2 (por el poco ahorro)



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¿Cómo ahorrar en tu factura?

Desplaza tu consumo a horas baratas

Así consumes la energía cada hora, entre semana y los fines de semana. Hemos detectado que consumes el 24% de la energía en horas P1 (el periodo caro). Desplazando el 10% de tu consumo en P1 a las horas P3, programando el encendido de la lavadora o el calentador, podrías ahorrar hasta 174 € cada año.

+ Información

¿Qué debes saber sobre los tres periodos de energía?

La tarifa 2.0TD tiene tres periodos horarios, cuyo precio varía según día y hora.

P1 es el periodo caro, horas punta.

P2 es el periodo intermedio, horas llano.

P3 es el periodo barato, horas valle, y también incluye todo el fin de semana y festivos.

Te recomendamos programar tus consumos para que se enciendan en horas de período P3 entre las 00:00 y las 08:00 de los días laborales o a cualquier hora durante el fin de semana y festivos, ¡cuando la energía es más barata!

València Clima i Energia · Oficina de l'Energia

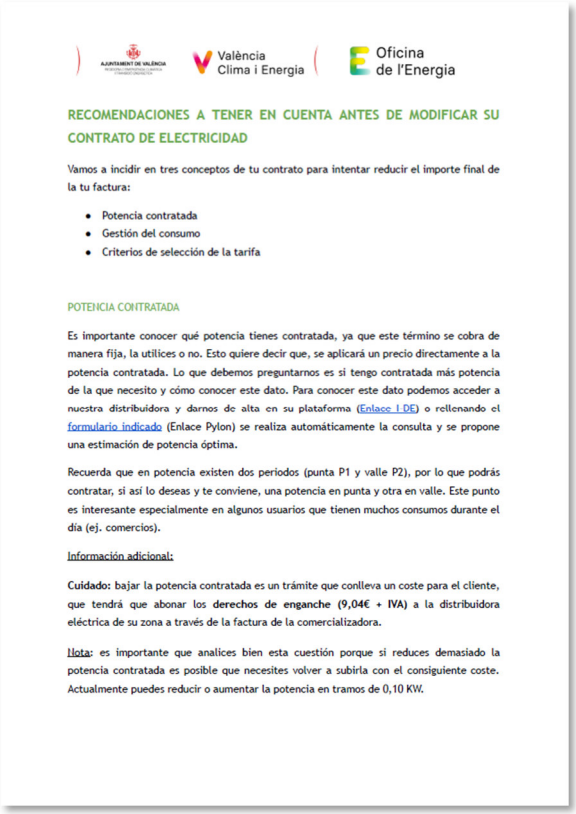
¿Cómo ahorrar en tu factura?

Cambia tu tipo de tarifa

Puedes cambiar a una tarifa con precios más competitivos.
Te mostramos el precio medio de energía que pagarías en base al histórico de tus consumos horarios.
El potencial ahorro que mostramos a continuación contempla la optimización de potencia sugerida.

Tipo de tarifa	Precios tarifa por periodo	Precio medio	Potencial ahorro
Tarifa actual	P1 0,357 €/kWh · P2 0,320 €/kWh · P3 0,293 €/kWh · P1 0,083 €/kW día · P2 0,004 €/kW día	0,316 €/kWh	
Tarifa sugerida	P1 0,357 €/kWh · P2 0,320 €/kWh · P3 0,293 €/kWh · P1 0,083 €/kW día · P2 0,004 €/kW día	0,316 €/kWh	46,20 €/Año**

*Estos precios medios y el informe se han realizado con los precios indexados hora a hora.
**El potencial ahorro está calculado incluyendo tasas (IEE e IVA).



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RECOMENDACIONES A TENER EN CUENTA ANTES DE MODIFICAR SU CONTRATO DE ELECTRICIDAD

Vamos a incidir en tres conceptos de tu contrato para intentar reducir el importe final de la tu factura:

- Potencia contratada
- Gestión del consumo
- Criterios de selección de la tarifa

POTENCIA CONTRATADA

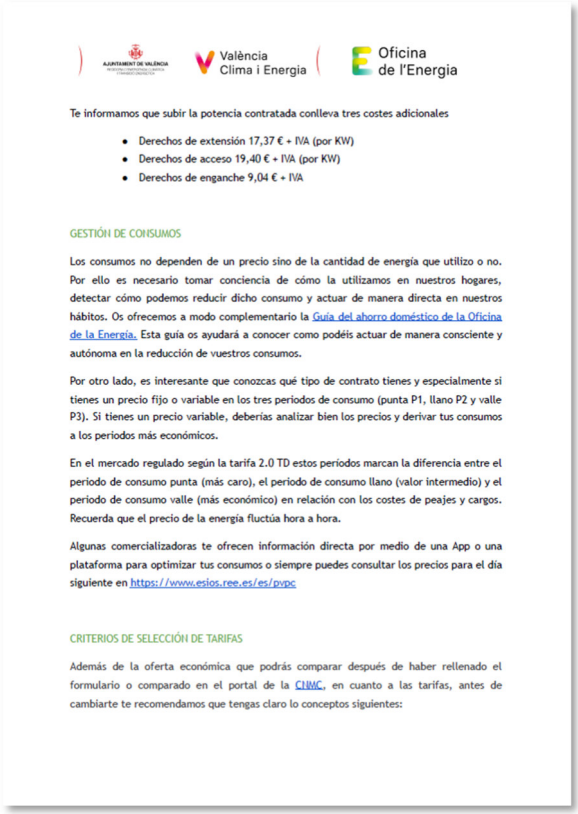
Es importante conocer qué potencia tienes contratada, ya que este término se cobra de manera fija, la utilices o no. Esto quiere decir que, se aplicará un precio directamente a la potencia contratada. Lo que debemos preguntarnos es si tengo contratada más potencia de la que necesito y cómo conocer este dato. Para conocer este dato podemos acceder a nuestra distribuidora y darnos de alta en su plataforma (Enlace I-DE) o rellenando el formulario indicado (Enlace Pylon) se realiza automáticamente la consulta y se propone una estimación de potencia óptima.

Recuerda que en potencia existen dos periodos (punta P1 y valle P2), por lo que podrás contratar, si así lo deseas y te conviene, una potencia en punta y otra en valle. Este punto es interesante especialmente en algunos usuarios que tienen muchos consumos durante el día (ej. comercios).

Información adicional:

Cuidado: bajar la potencia contratada es un trámite que conlleva un coste para el cliente, que tendrá que abonar los **derechos de enganche (9,04€ + IVA)** a la distribuidora eléctrica de su zona a través de la factura de la comercializadora.

Nota: es importante que analices bien esta cuestión porque si reduces demasiado la potencia contratada es posible que necesites volver a subirla con el consiguiente coste. Actualmente puedes reducir o aumentar la potencia en tramos de 0,10 KW.



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Te informamos que subir la potencia contratada conlleva tres costes adicionales

- Derechos de extensión 17,37 € + IVA (por KW)
- Derechos de acceso 19,40 € + IVA (por KW)
- Derechos de enganche 9,04 € + IVA

GESTIÓN DE CONSUMOS

Los consumos no dependen de un precio sino de la cantidad de energía que utilizo o no. Por ello es necesario tomar conciencia de cómo la utilizamos en nuestros hogares, detectar cómo podemos reducir dicho consumo y actuar de manera directa en nuestros hábitos. Os ofrecemos a modo complementario la Guía del ahorro doméstico de la Oficina de la Energía. Esta guía os ayudará a conocer como podéis actuar de manera consciente y autónoma en la reducción de vuestros consumos.

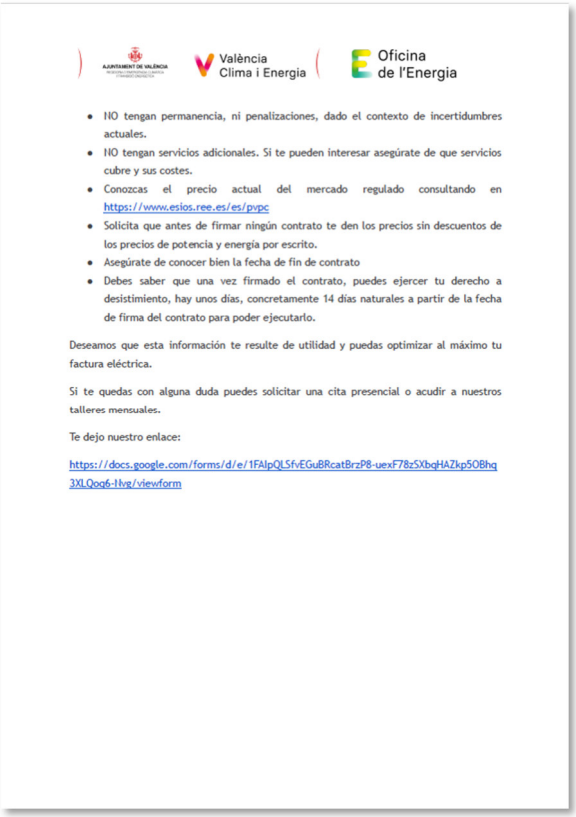
Por otro lado, es interesante que conozcas qué tipo de contrato tienes y especialmente si tienes un precio fijo o variable en los tres periodos de consumo (punta P1, llano P2 y valle P3). Si tienes un precio variable, deberías analizar bien los precios y derivar tus consumos a los periodos más económicos.

En el mercado regulado según la tarifa 2.0 TD estos periodos marcan la diferencia entre el periodo de consumo punta (más caro), el periodo de consumo llano (valor intermedio) y el periodo de consumo valle (más económico) en relación con los costes de peajes y cargos. Recuerda que el precio de la energía fluctúa hora a hora.

Algunas comercializadoras te ofrecen información directa por medio de una App o una plataforma para optimizar tus consumos o siempre puedes consultar los precios para el día siguiente en https://www.esios.ree.es/es/pvpc

CRITERIOS DE SELECCIÓN DE TARIFAS

Además de la oferta económica que podrás comparar después de haber rellenado el formulario o comparado en el portal de la CNMC, en cuanto a las tarifas, antes de cambiarte te recomendamos que tengas claro lo conceptos siguientes:



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- NO tengan permanencia, ni penalizaciones, dado el contexto de incertidumbres actuales.
- NO tengan servicios adicionales. Si te pueden interesar asegúrate de que servicios cubre y sus costes.
- Conozcas el precio actual del mercado regulado consultando en https://www.esios.ree.es/es/pvpc
- Solicita que antes de firmar ningún contrato te den los precios sin descuentos de los precios de potencia y energía por escrito.
- Asegúrate de conocer bien la fecha de fin de contrato
- Debes saber que una vez firmado el contrato, puedes ejercer tu derecho a desistimiento, hay unos días, concretamente 14 días naturales a partir de la fecha de firma del contrato para poder ejecutarlo.

Deseamos que esta información te resulte de utilidad y puedas optimizar al máximo tu factura eléctrica.

Si te quedas con alguna duda puedes solicitar una cita presencial o acudir a nuestros talleres mensuales.

Te dejo nuestro enlace:

https://docs.google.com/forms/d/e/1FAIpQLSfvEGuBRcatBrzP8-uexF78zSXbqHAZkp5OBhq3XLQoq6-Hvg/viewform

Annex 5 – Example of renovEU preliminary report for a Deep renovation and its budget.

A. RenovEU preliminary report

renovEU
Informe preliminar

Informe preparado para la referencia catastral:

7425610YJ2772E

Este documento muestra el resultado de la aplicación renovEU (http://renoveu.five.es) sobre el edificio seleccionado. Es importante recordar que los parámetros, cálculos y valores expresados se basan en tipologías, por lo que los resultados corresponden a un edificio representativo, lo más parecido posible al seleccionado.

1. Datos del edificio

Según dirección facilitada o coordenadas y datos disponibles de catastro, se clasifica como Edificio de viviendas, con las siguientes características:

	Edificio seleccionado	Edificio modelo
Dirección:	CL CHILE 4 VALENCIA (VALENCIA)	ZONA MEDITERRÁNEA
Uso principal:	**Residencial**	**Residencial**
Superficie techo:	2.553 m2	4.068,9 m2
Número de plantas:	9	9
Número de viviendas:	14	27
Zona climática:	B3	
Año de construcción:	1990	1980 - 2006

Este Proyecto recibe financiación del programa marco de la Unión europea H2020 para la investigación e innovación bajo el acuerdo núm. 892749

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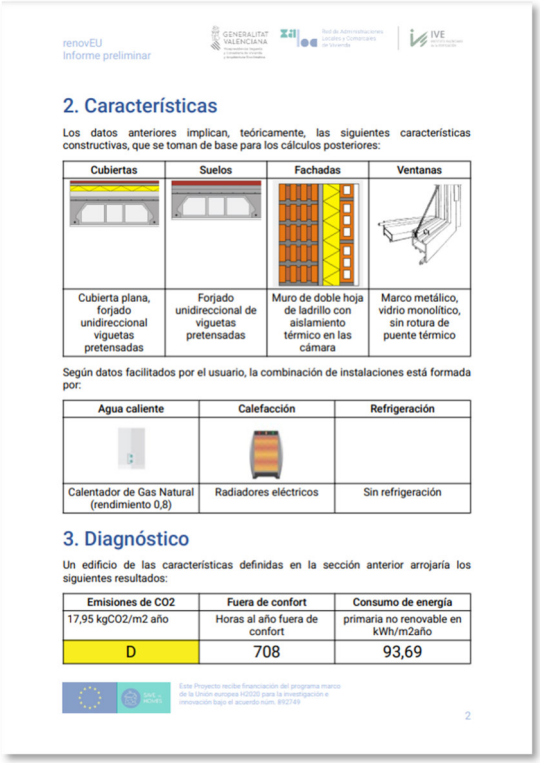

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2. Características

Los datos anteriores implican, teóricamente, las siguientes características constructivas, que se toman de base para los cálculos posteriores:

Cubiertas	Suelos	Fachadas	Ventanas
Cubierta plana, forjado unidireccional viguetas pretensadas	Forjado unidireccional de viguetas pretensadas	Muro de doble hoja de ladrillo con aislamiento térmico en las cámara	Marco metálico, vidrio monolítico, sin rotura de puente térmico

Según datos facilitados por el usuario, la combinación de instalaciones está formada por:

Agua caliente	Calefacción	Refrigeración
Calentador de Gas Natural (rendimiento 0,8)	Radiadores eléctricos	Sin refrigeración

3. Diagnóstico

Un edificio de las características definidas en la sección anterior arrojaría los siguientes resultados:

Emisiones de CO2	Fuera de confort	Consumo de energía
17,95 kgCO2/m2 año	Horas al año fuera de confort	primaria no renovable en kWh/m2año
D	708	93,69

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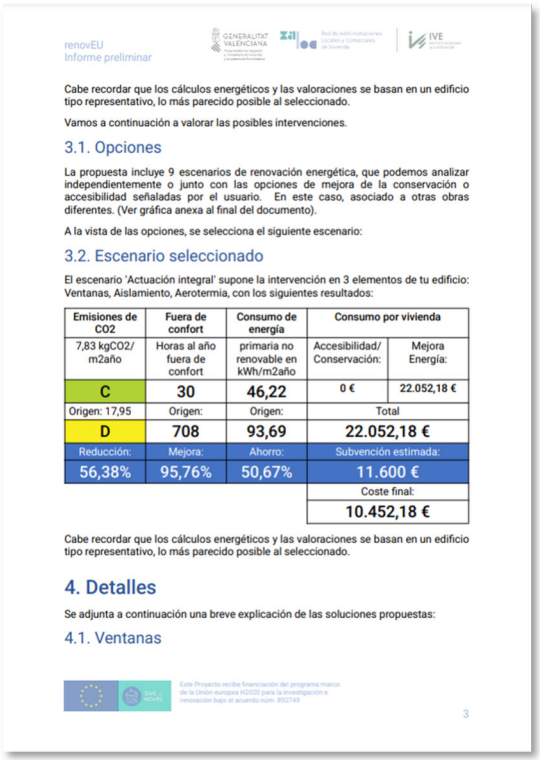

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Cabe recordar que los cálculos energéticos y las valoraciones se basan en un edificio tipo representativo, lo más parecido posible al seleccionado.

Vamos a continuación a valorar las posibles intervenciones.

3.1. Opciones

La propuesta incluye 9 escenarios de renovación energética, que podemos analizar independientemente o junto con las opciones de mejora de la conservación o accesibilidad señaladas por el usuario. En este caso, asociado a otras obras diferentes. (Ver gráfica anexa al final del documento).

A la vista de las opciones, se selecciona el siguiente escenario:

3.2. Escenario seleccionado

El escenario 'Actuación integral' supone la intervención en 3 elementos de tu edificio: Ventanas, Aislamiento, Aerotermia, con los siguientes resultados:

Emisiones de CO2	Fuera de confort	Consumo de energía	Consumo por vivienda	
7,83 kgCO2/m2año	Horas al año fuera de confort	primaria no renovable en kWh/m2año	Accesibilidad/ Conservación:	Mejora Energía:
C	30	46,22	0 €	22.052,18 €
Origen: 17,95	Origen:	Origen:	Total	
D	708	93,69	22.052,18 €	
Reducción:	Mejora:	Ahorro:	Subvención estimada:	
56,38%	95,76%	50,67%	11.600 €	
			Coste final:	
			10.452,18 €	

Cabe recordar que los cálculos energéticos y las valoraciones se basan en un edificio tipo representativo, lo más parecido posible al seleccionado.

4. Detalles

Se adjunta a continuación una breve explicación de las soluciones propuestas:

4.1. Ventanas

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¿Cuál es el problema?

Las ventanas son uno de los puntos más débiles en la envolvente de un edificio o vivienda, dado su bajo nivel de aislamiento en comparación con una fachada aislada; es decir, transmiten con mayor facilidad el calor. Las ventanas favorecen la entrada de radiación solar directa durante los periodos fríos, reduciendo las necesidades de calefacción. Sin embargo, dicha radiación se debe bloquear mediante elementos de sombra móvil, durante los periodos cálidos. Además de las propiedades térmicas, constituyen la principal entrada de luz natural en la vivienda, y juegan un papel destacado en el aislamiento acústico.

¿Qué te proponemos?

La instalación de ventanas que garanticen la entrada suficiente de luz solar y minimicen las pérdidas de calor en la vivienda, además de asegurar un cierre hermético en las mismas, es de vital importancia. La elección de marcos con baja conductividad térmica, la incorporación de cámaras entre vidrios y la aplicación de tratamientos superficiales en los mismos son clave para el diseño de una ventana con altas prestaciones. Por último, las ventanas en las orientaciones soleadas deben acompañarse de elementos de sombra móvil (e.g., persianas, lamas, toldos, etc.) para evitar ganancias de calor no deseadas en los periodos cálidos.

4.2. Aislamiento

¿Cuál es el problema?

La fachada de un edificio está expuesta, por un lado, al interior de la vivienda con temperaturas de confort (21°C-25°C), y por el otro, al ambiente exterior con temperaturas bajas en invierno (incluso por debajo de 0°C) y altas en verano (incluso por encima de 40°C), estas grandes diferencias de temperatura entre sus dos caras hacen que el flujo de calor y, por tanto, las pérdidas de energía sean críticas a través de estos elementos si no se dispone de un aislamiento térmico adecuado. Sin embargo, la normativa no siempre obligó a incorporar aislamiento térmico. Por lo tanto, los edificios construidos con anterioridad a 1979 están carentes de aislante térmico, mientras que los edificios construidos con posterioridad a 1979 aún pudiendo existir este aislante, éste suele ser insuficiente, tanto a nivel de espesor como de calidad del material.

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¿Qué te proponemos?

La incorporación de un aislante térmico adecuado en fachadas y cubiertas, atendiendo tanto a calidad del material, como al espesor del mismo, es imprescindible para reducir el consumo de energía de las viviendas. Se recomienda, siempre que sea posible, el aislamiento por el exterior, ya que no reduce la superficie útil de la vivienda y permite, además, reducir las pérdidas de energía asociadas a los puentes térmicos.

4.3. Aerotermia

¿Cuál es el problema?

Las necesidades energéticas asociadas a los servicios de calefacción, refrigeración y agua caliente sanitaria (ACS) representan una parte notable de la demanda energética total de las viviendas. Esto añadido a los problemas derivados del cambio climático y el uso de combustibles fósiles, crea la necesidad de incentivar la eficiencia energética y promover la electrificación. Entre los sistemas más eficientes del mercado actual, se encuentra la aerotermia. La aerotermia se basa en la tecnología de bomba de calor que permite suministrar los servicios de calefacción, refrigeración y ACS aprovechando la energía del ambiente.

¿Qué te proponemos?

La apuesta por un sistema de aerotermia en las viviendas, además de reducir el consumo energético de las mismas y contribuir a la disminución de las emisiones de dióxido de carbono, conlleva un mayor confort térmico en la vivienda. Los sistemas de bomba de calor representan la opción tecnológica más eficiente del mercado, hasta 5 veces más eficientes que las calderas de combustión convencionales. Este hecho hace que sean una pieza clave en la transición energética actual.

5. Desglose del presupuesto

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Finalmente, la valoración económica detallada de las actuaciones de mejora de la eficiencia energética, incluyendo IVA del 10%, por edificio y vivienda, en base a los precios disponibles en la base de precios del IVE y el edificio modelo que referencia a la tipología, se encuentra disponible para la descarga en la sección lateral de la pantalla 5, con el nombre 'Memoria valorada'.

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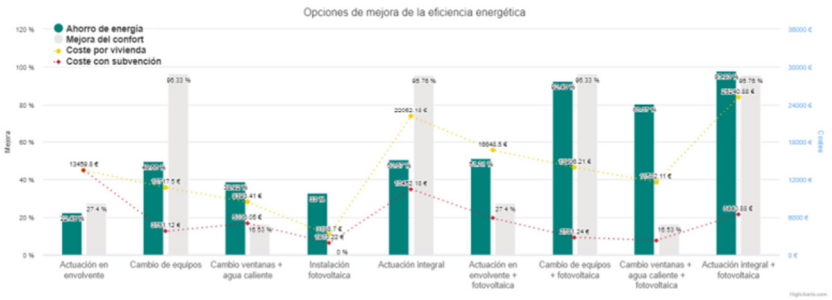
Anexo



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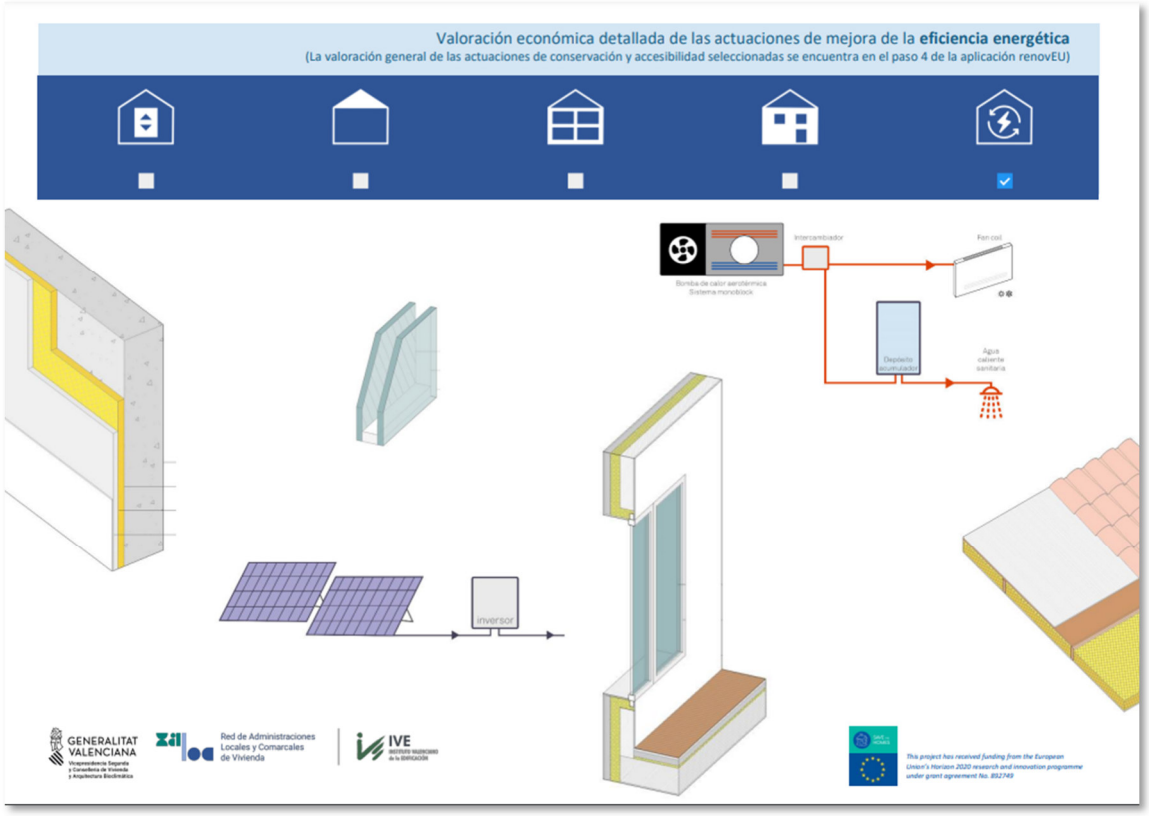
B. Detailed budget (extract)



Edificio tipo

Categoría:
Bloque de viviendas
Zona climática:
B3
Periodo de construcción:
Entre 1980 y 2006

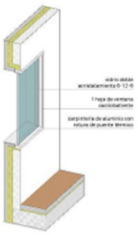
Características

N.º de viviendas	27
N.º de viviendas por planta	3
N.º de plantas	9
Superficie por vivienda (m2)	86
N.º de estancias	3
N.º de baños	2

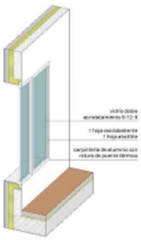
Superficies (m²)

Fachada 1	1760
Fachada 2	-
Medianera	-
Cubierta plana	258
Cubierta inclinada	-
Suelo en contacto con el terreno	-
Suelo en contacto con recinto no habitable	300
Suelo en contacto con el exterior	36

Valoración de actuaciones de mejora



Huecos habitaciones	Ventana 165x120cm compuesta por 1 hoja oscilobatiente y 1 hoja abatible realizada con perfiles de aluminio anodizado con rotura de puente térmico, junto con todos los elementos y accesorios que garanticen su correcto funcionamiento y estanquidad. Acabado en color natural para recibir un acristalamiento de hasta 38 mm.	60.012.41 €	2.222.68 €
Huecos cocina		20.004.14 €	740.89 €



Huecos baños	Ventana oscilobatiente 90x120cm compuesta por 1 hoja realizada con perfiles de aluminio anodizado con rotura de puente térmico, junto con todos los elementos y accesorios que garanticen su correcto funcionamiento y estanquidad. Acabado en color natural para recibir un acristalamiento de hasta 38mm.	12.412.11 €	459.71 €
Huecos escalera		4.137.37 €	153.24 €

GENERALITAT VALENCIANA
Vicepresidencia Segunda y Conselleria de Vivienda y Arquitectura Bioclimática

Red de Administraciones Locales y Comarcales de Vivienda

IVE Instituto Valenciano de la Edificación

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 892749

Edificio tipo

Categoría:
Bloque de viviendas
Zona climática:
B3
Periodo de construcción:
Entre 1980 y 2006

Características

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Cubierta inclinada	-
Suelo en contacto con el terreno	-
Suelo en contacto con recinto no habitable	300
Suelo en contacto con el exterior	36

Valoración de actuaciones de mejora

Resumen de la valoración de las actuaciones

Presupuesto de ejecución material	454.857,75 €
Presupuesto de Ejecución por contrata con IVA	595.408,80 €
Presupuesto de Ejecución por Contrata con IVA, por vivienda	22.052,18 €
Presupuesto de Ejecución por Contrata con IVA, por metro cuadrado	256,42 €/m²

Las soluciones de renovación energética y el cálculo de los ahorros y valoraciones asociados a ellas están en línea con las condiciones de las subvenciones establecidas en el Real Decreto 853/2021, de 5 de octubre, por el que se regulan los programas de ayuda en materia de rehabilitación residencial y vivienda social del Plan de Recuperación, Transformación y Resiliencia.

Para el cálculo del PEC se consideran gastos generales del 13% y beneficio industrial del 6%, así como un IVA del 10%. Los cálculos de las valoraciones se basan en el modelo tipo edificatorio y precios de la Base de datos IVE. En todo momento, los parámetros, cálculos y valores están basados en tipologías, por lo que los resultados corresponden a un edificio representativo, lo más parecido posible al seleccionado en la aplicación.

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Vicepresidencia Segunda y Conselleria de Vivienda y Arquitectura Bioclimática

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Annex 6 – Questionnaire for collecting building characteristics and occupant profile.

1. Initial data (from cadastral and information gathered during the selection process)

INITIAL DATA		
1. General data	# number of monitoring case	
	Type of monitoring	
	Typology	
2. Personal data	Name	
	Address	
	City	
	Climate zone	
	Email	
	Telephone number	
3. Dwelling data	Constructed surface (Cadastral)	
	Year of construction	
	Current regulation	
	Cadastral reference	
	Listed building	
	Typer of building	
	Number of floors (building)	
	Dwelling location in building	
4. Facilities data	DHW	
	Heating	
	Cooling	
	Other	
5. Other data	Layouts	
	Energy performance certificate	
	Registered data	
	Gas bills	
6. Renovation measures after 2020?	Windows	
	Insulation (façade or roof)	
	DHW	
	Heating/Cooling	
	PV	
	Other	
	Date of measures	
7. Upcoming renovation measures?	Windows	
	Insulation (façade or roof)	
	DHW	
	Heating/Cooling	
	PV	
	Other	
	Expected date of measures	

2. Dwelling data (from occupants' interview)

DWELLING DATA		
1. General info	Orientation	
	Number of floors	
	Number of rooms	
	Number of baths	
2. Occupant profile	Tenant/Owner	
	Home occupancy range	
	Number of occupants < 18	
	Number of occupants 18-65	
	Number of occupants > 65	
3. Facilities	**Lighting**	
	Type	
	Control system and sensors	
	DHW	
	Type	
	Year	
	Heating system	
	Type	
	Year	
	Control system and sensors	
	Setpoint temperature	
	Months of use	
	Cooling system	
	Type	
	Year	
	Control system and sensors	
	Setpoint temperature	
	Months of use	
	Ventilation	
	Type	
	Control system and sensors	
	Year	
	Photovoltais panels	
	kWp	
	Year	
	Appliances	
	Fridge	
	Washing machine	
	Dryer	
	Dishwasher	
	Oven	
	Type of cooker	
	Control system and sensors	
4. Envelope	**Windows**	
	Type of glass	
	Type of frame	
	Type of opening	
	Air tightness	
	Blinds	
	Curtains	
	Solar protection	
	Façade	
	Width	
	Type	
	Roof	
	Sloping/flat	
	Type	
	Floor	
	Type	

3. Subjective wellbeing data (from occupants' interview)

SUBJECTIVE WELLBEING DATA								
1. Indoor parameters	**How often do you experience discomfort due to…?**	**Never**	**Hardly ever**	**Sometimes**	**Frequently**	**Quite often**		
	Dry air							
	Humid air							
	Stuffy "bad" air							
	Unpleasant odour							
	Dust and dirty							
	Noise							
	Draught							
	Indoor temperature too high							
	Indoor temperature too low							
	Light that is dim							
	Light that causes glare and/or reflections							
2. Symptoms	**How often do you experience the following complaints…?**	**Never**	**Hardly ever**	**Sometimes**	**Frequently**	**Quite often**		
	Fatigue							
	Feeling heavy-headed							
	Headache							
	Dizziness							
	Difficulties concentrating							
	Itching, burning or irritation of the eyes							
	Visual disturbances							
	Irritated, sutffy or runny nose							
	Hoarse, dry throat							
	Respiratoyry problems							
	Sneezing, stuffy nose							
	Other….							
3. Cold/hot wall	**Do you feel the floor or wall cold/hot?**	**Never**	**Hardly ever**	**Sometimes**	**Frequently**	**Quite often**		
	cold wall/window in winter							
	hot wall/window in summer							
4. Thermal feeling	**Indoor thermal feeling**	**Hot**	**Warm**	**Slightly warm**	**Neutral**	**Slightly cool**	**Cool**	**Cold**
	In winter, in your house it usually does…							
	In summer, in your house you usually do…							
5. Clothing	**Clothing**	**Nothing/Underwear**	**Light clothing**	**2 layers**	**Coat or more than 2 layers**			
	In winter, you usually wear...							
	In summer, you usually wear...							

4. Renovation measures data (from occupants' interview)

4.1. Dwellings with measures implemented.

DWELLINGS WITH MEASURES IMPLEMENTED		
1. Measures after 2020	**Implemented measures**	
	Windows	
	Insulation (façade and/or roof)	
	DHW	
	Heating/Cooling	
	PV	
	Other	
	Date of the renovation measures	
	Reasons for the renovation	
	Too cold in winter	
	Too hot in summer	
	Too noisy	
	High humidity and/or mold	
	High energy consumption/cost	
	Other problems	
	It didn't have problems	
	Pictures previous state	
2. Feedback	Global appreciation of the works	
	Global appreciation of the measures	
	What has been the most difficult part of the process?	
	Have pre-existing problems improved?	
	Have you reduced your energy bills?	
3. Cost	Cost of the measures	
	Have you applied for Next Generation grants?	
	Has it been easy for you to process the grants?	
4. Tools	Have you used the renovEU tool?	
	Has the renovEU tool been useful to you?	
	Have you gone to the Energy Office/Xaloc?	
	Has the OE/Xaloc been useful to you?	
5. Upcoming measures	**Are you going to implement more measures?**	
	Windows	
	Insulation (façade and/or roof)	
	DHW	
	Heating/Cooling	
	PV	
	Other	
	Reasons for further improvements	
	Are you going to apply for Next Generation grants?	

4.2. Dwellings without measures implemented.

DWELLINGS WITHOUT MEASURES IMPLEMENTED		
1. Upcoming measures	**Are you going to implement renovation measures?**	
	Windows	
	Insulation (façade and/or roof)	
	DHW	
	Heating/Cooling	
	PV	
	Other	
	Planned date	
2. Reasons for renovation	**Razones para llevar a cabo mejoras**	
	Too cold in winter	
	Too hot in summer	
	Too noisy	
	High humidity and/or mold	
	High energy consumption/cost	
	Other problems	
	It didn't have problems	
3. Budget	**Estimated budget**	
4. Grants	**Are you going to apply for Next Generation grants?**	
	Are you going to use renovEU tool?	
	Are you going to visit the energy office/Xaloc?	
5. Problems	**Biggest obstacles in the process so far**	

Annex 7 – Recommendation Reports

Recommendation reports provided to four homes having participated in the monitoring campaign.