Energy Efficiency Performance-Tracking Platform for Benchmarking Savings and Investments in Buildings

Training material package for using EN-TRACK by building owners and contractors (final report)

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.

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Abbreviations and Acronyms

Acronym	Description
API	Application Programming Interfaces
BO	Building Owners and Operators
EEI	Energy Efficiency Investment
EEM	Energy Efficiency Measure
EUI	Energy Use Intensity (EUI)
ECI	Energy Cost Intensity (ECI)
CEI	Carbon Emissions Intensity (CEI)
EUSI	Energy Use Saving Intensity (EUSI)
ESCI	Energy Cost Saving Intensity (ECSI)
ESI	Emissions Saving Intensity (ESI)
NIC	Normalised Investment Cost (NIC)
AC	Avoidance Cost (AC)
SP	Simple Payback (SP)
NVP	Net Present Value (NPV)
PO	Profitability Index (PI)
NPVq	Net Present Value Quotient (NPVq)
IRR	Internal Rate of Return (IRR)

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1 Executive summary

This document builds upon the interim training materials package and aims at providing support for the building owners and operators (BO) using the EN-TRACK platform. While the first document was focused more on general description of the platform functionalities and the available data sources to be used for supplementing the platform with data, the main focus of this report is to provide training materials for BO who are already using the platform.

The report begins with a section providing step-by-step guidance for the registration process, followed by instructions for provision of data. This is followed by a focus on the outputs that EN-TRACK provides. The report then concludes with guidance on how BO can best use the outputs during their day-to-day work.

As the platform will be open for non-registered users (with limited functionalities), who will have access to general statistical data, a guide for them for accessing and downloading the main outputs is also included.

In the Appendixes (A to D) a detailed overview of the data sources available both in Spain and Bulgaria is given, as in many cases non experts are expected to input data to be used by the management of the organisations registered.

2 Background

EN-TRACK, a H2020 project, develops a “one-stop-shop” platform that will facilitate both BO and financial institutions (FI) in identifying and implementing building renovation projects. The platform will collect and provide standardised data on buildings energy performance and the results of already implemented energy efficiency measures, creating trust in investors and supporting BO in the decision-making process.

To achieve this goal, the platform needs accurate data on building energy performance and energy consumption. Such data is usually available, but often in forms that are not convenient for further processing. Examples include paper invoices or scanned documents. A specific barrier for Bulgarian users is also the fact that energy consumption data (paper invoices or PDFs) are usually obtained by the site accountants, who very often do not have the necessary experience to read the information correctly and provide the municipal experts, in charge of the building stock, with the correct values. Although situation is Spain differs, and data about electricity consumption is available online (Datadis platform), many BO lack familiarity with this platform and its benefits.

In view of the above, one of the specific objectives of the EN-TRACK project is to facilitate BO in the task of collecting and verifying the available data on the buildings they manage and to provide them with specific support services related to both managing their buildings more efficiently and attracting funding to improve their energy performance.

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3 Introduction

The purpose of this document is to support building owners and operators (BO) in using the EN-TRACK platform and making the most of its functionalities. It provides a comprehensive step-by-step guidance on the following: 1) Registration and settings; 2) Provision of data; 3) Understanding the outputs; and 4) Using the outputs. The permanent Help Desk provided at the project website also contributes to this support function.

It should be noted that this document contains some distinct information for Bulgarian and Spanish users that is highlighted by a change in text colour where appropriate (*Bulgarian* and *Spanish)*.

4 Registration and settings

The first step for any organisation willing to take advantage of the features of the EN-TRACK platform is to register and assign roles to individual users/sub-users. Each organisation can assign different experts with different responsibilities. For example, one expert may only have access to a specific building, while others may service multiple buildings. It is possible for one user to have access to all the organisation's sites. It is recommended that the roles and rights of the users are discussed in advance with the relevant expert who will perform the initial registration. The users' hierarchy from lowest to highest permissions is as follows:

1. BUILDING_USER

This type of user is granted with access to check building data and the analytics results.

2. BUILDING_ADMINISTRATOR

On top of the above, this type of user is granted with permissions to manage building data and update it if necessary. For the Bulgarian pilot this is the top access each organisation/municipality will be granted at this stage. Thus, for registering new users the organisation should contact EnEffect Consult at eneffect@eneffect.bg or +359 2 963 1714.

3. ORGANISATION_ADMINISTRATOR

This type of user is granted with access to all buildings of the respective organisation and can also manage (change/create/delate) both lower level user profiles and organisation details. In the case of Bulgaria this role will be given to EnEffect Consult who will be responsible for user management. For Spanish users this role is given to the respective organisation who can manage the 1st and 2nd level users as shown below:

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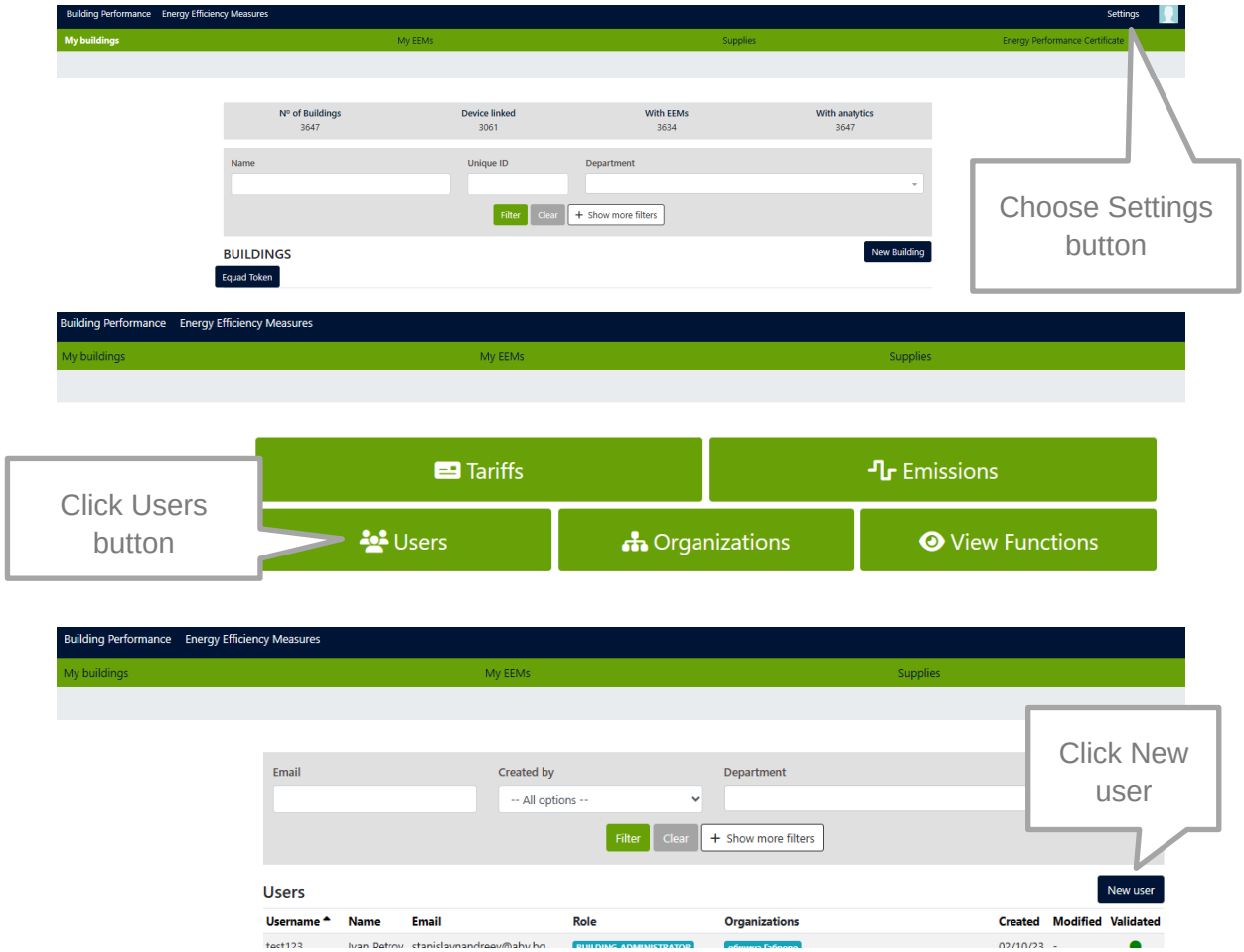

Then fill in the respective fields with information about Username, Email, Language, and Role (after completing the action an email for verification will be send to the user.

Important note: All new users should complete the verification within 24 hours of receiving the instructions by email.

4. SUPERUSER

CIMNE as platform operator.

Different employees/experts from one organisation/municipality can use the platform and have different roles according to their duties and responsibilities. Creating multiple BUILDING_USER and BUILDING_ADMINISTRATOR profiles is highly recommendable for larger organisations that operate more than 20 – 30 buildings. This is because the volume of data is significant and this enables the burden to be shared, facilitating the process and efficient information upload, and avoiding overloading any one single expert. For organisations with a limited number of buildings the platform can be used by a single user (BUILDING_ADMINISTRATOR in Bulgarian case and ORGANISATION_ADMINISTRATOR in the Spanish case). Ultimately, this is still a management decision. Managing accounts and adding/removing users can be done at any time once the organisation has gained experience using the platform and has accurately determined its needs and capabilities.

The following steps are required for each organisation to register:

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Bulgarian users:

1. Contact EnEffect Consult at eneffect@eneffect.bg or +359 2 963 1714. Our experts will discuss with you the users and their assignments and make your registrations.
2. All registered users will receive activation e-mail with a link to create their own password. On following the link you will be redirected to a screen where you will need to write your password twice.

Spanish users:

1. Contact the organisation's administrator. The administrator will assign the role within the organisation as well as the department to which it belongs from which it can manage the buildings assigned to it.
2. All registered users will receive activation e-mail with a link to create their own password. On following the link you will be redirected to a screen where you will need to write your password twice.
3. The ORGANISATION_ADMINISTRATOR user can then manage the registration of other users.

Indicative structure for the Bulgarian users:

The common structure applied for the Bulgarian Pilot divided the energy and building experts in two groups:

- BUILDING ADMINISTRATOR: manage building data and update building information,
- BUILDING_USER: only check the building data and the analytics results.

Indicative structure for Spanish users:

The common structure applied for the Catalan Government Pilot divided the energy and building experts in three groups among all the different organisations that participated:

- ORGANISATION_ADMINISTRATOR: manage the whole organisation, all buildings, and all users,
- BUILDING ADMINISTRATOR: manage building data and update building information,
- BUILDING USER: could only check the building data and the analytics results.

The platform can also be used by non-registered users (visitors) but only with limited functionalities. For non-registered users see section *6.1 Information of all users*. The content available for visitors and for registered users who provide data (clients) is presented in the following diagrams.

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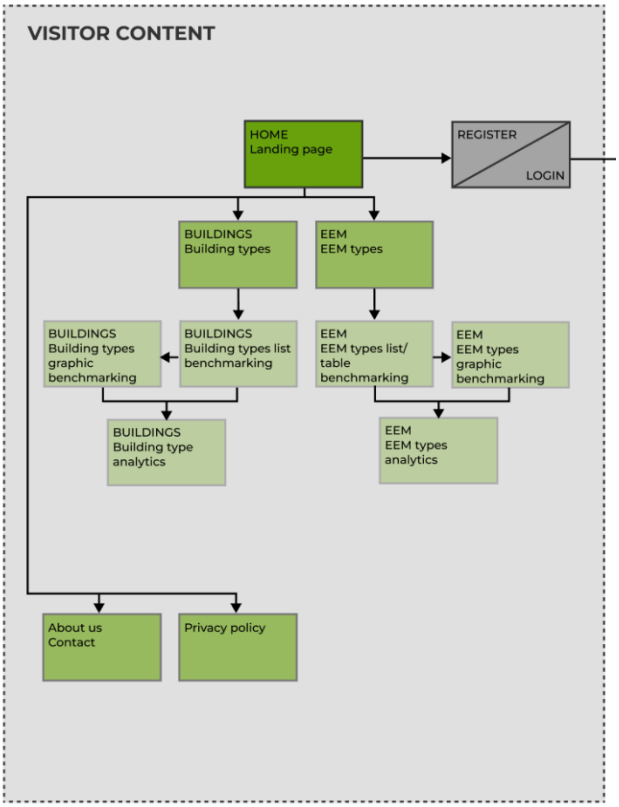

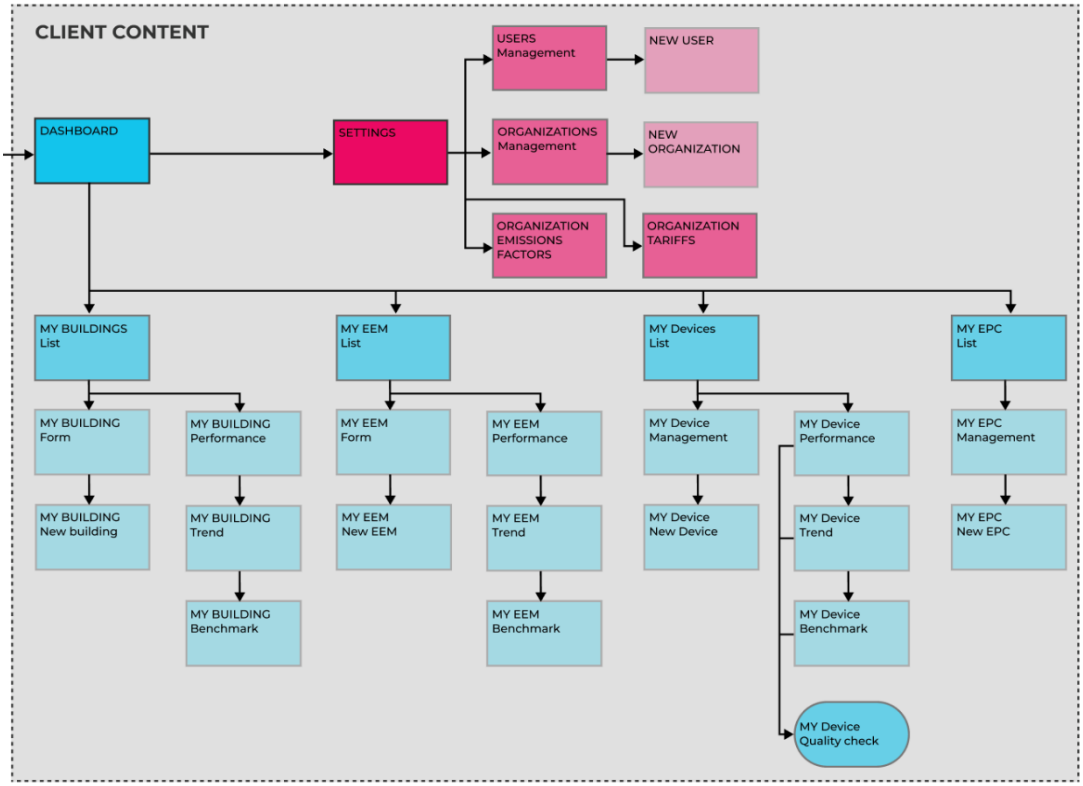

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5 Provision of data

In order for users to benefit from the full services offered by the EN-TRACK platform, they must provide data about their buildings. The more detailed the data provided, the more useful and interesting features of the platform will be opened to facilitate their activities.

The data needed by the platform can be divided into two groups as follows:

General building data. Can be filled in once and updated or supplemented as needed or if changes occur. This data includes:

GENERAL DATA

a. Building name

b. Organisation tree

BUILDING INFO

c. Organisation id

d. Opening/Closing hours

e. Use type

f. Construction year

LOCATION INFO

g. Climate zone

h. Address

i. Cadastral references

BUILDING SPACES INFO

j. Gross floor area (above ground, underground and total)

k. Unique Points of Delivery – UPOD (one or several, only for Spanish users where data consumption is read by the platform automatically)

l. Energy efficiency measures: Economic investment, start work date, start operational date, percentage of element or zone affected.

m. Elements (Not working): Building partitioning into different zones or independent elements.

For both Bulgarian and Spanish pilots some of the general building data is already implemented in the platform. However, additional information may be added manually by the users.

For Bulgarian users, the needed data is available in MS Excel format for all buildings that have energy audits respectively EPCs. The platform allows automatic upload of the standardised summary (Rezume) file (issued together with the EPC), which will save time and efforts for the relevant user (for more details see *Training material package for using EN-TRACK by building owners and contractors (interim report)* and **Appendix A**).

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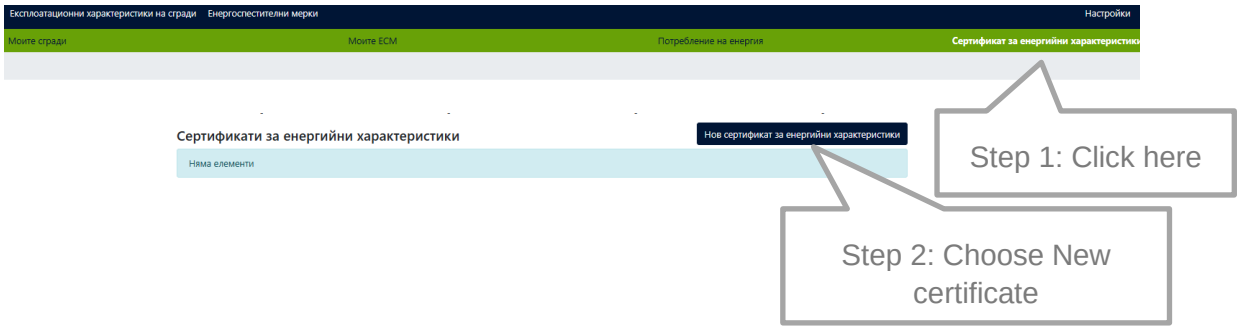
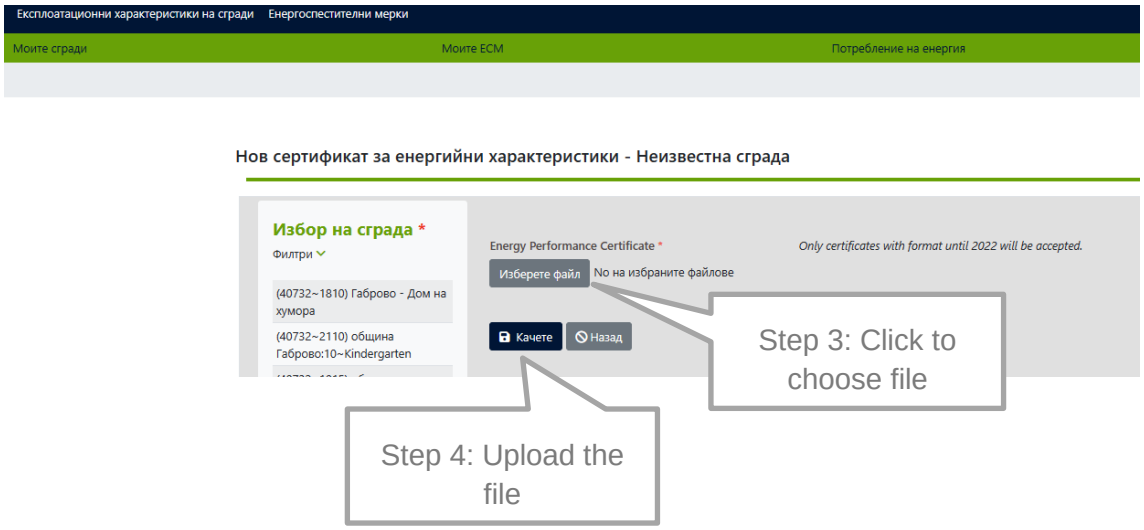
The following steps are needed to upload the MS Excel summary (Resume):



When a new window opens you can either choose to import a certificate for a new building (not existing in the platform) or choose an existing building from the list in the left. Then:



For the Spanish user, most of this data is available in the Energy Performance Certificate (EPC) of the building (for more details see *Training material package for using EN-TRACK by building owners and contractors (interim report)* and **Appendix C**). However, for the Catalan pilot, most of the buildings are already uploaded as the data was already available in an internal system.

For all new users who have the needed data systemised, CIMNE can support automatic uploading of the information is provided in a proper MS Excel file.

Energy and fuel consumption data. As a starting point, data on energy consumption in the building for the past period (at least one year) should be provided, and subsequently this data should be supplemented with information on current consumption, preferably on a monthly basis. Energy data sources are shown in detail in **Appendix B** (for Bulgarian users) and **Appendix D** (for Spanish users).

For the convenience of the users, MS Excel forms is available to be filled in and then easily uploaded to the platform in order to save time and to check for veracity beforehand. To download the form, users should choose the respective building and then follow the steps as shown below:

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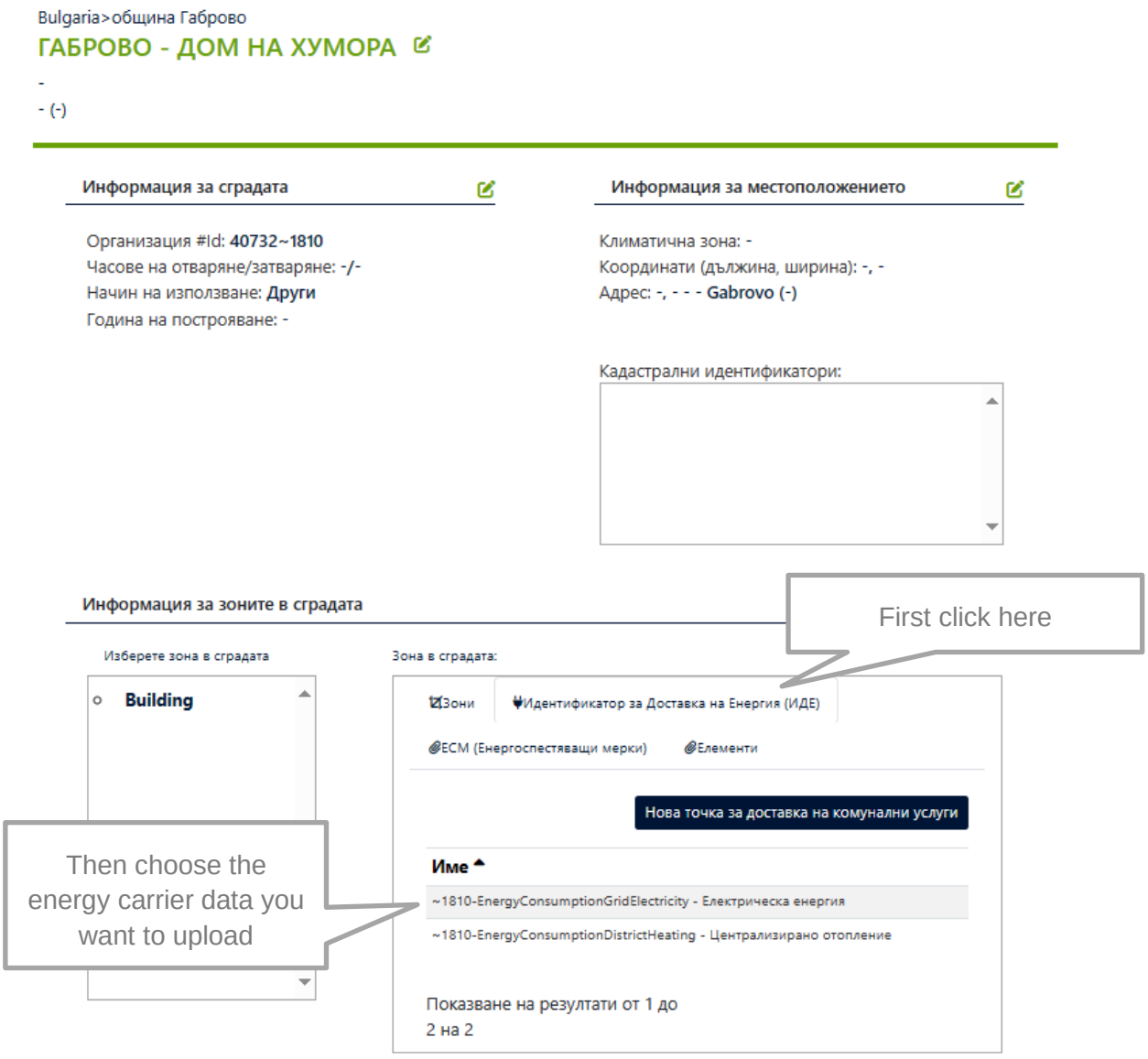
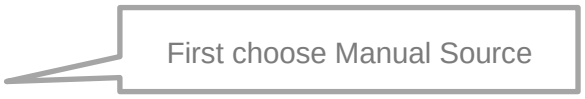


After a new window opens:



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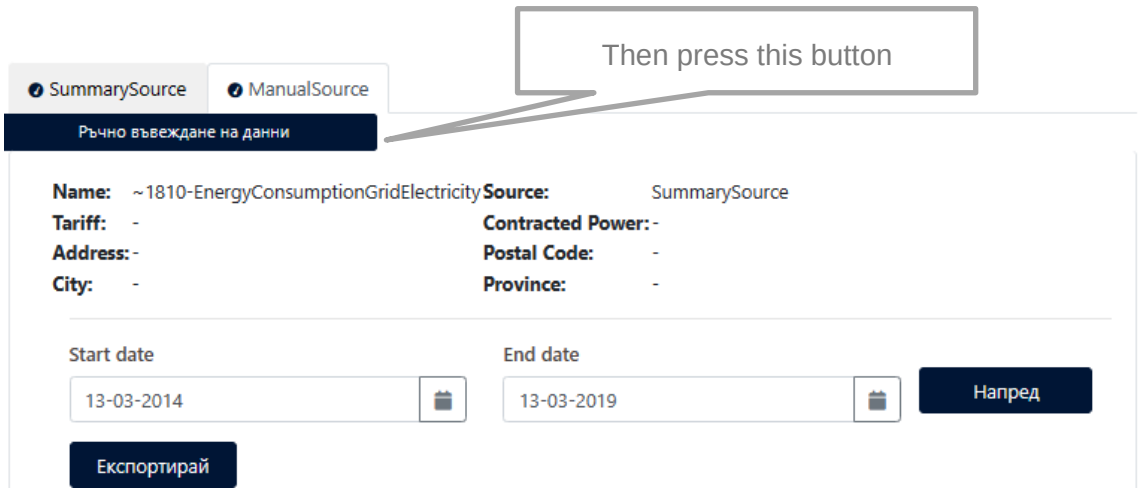
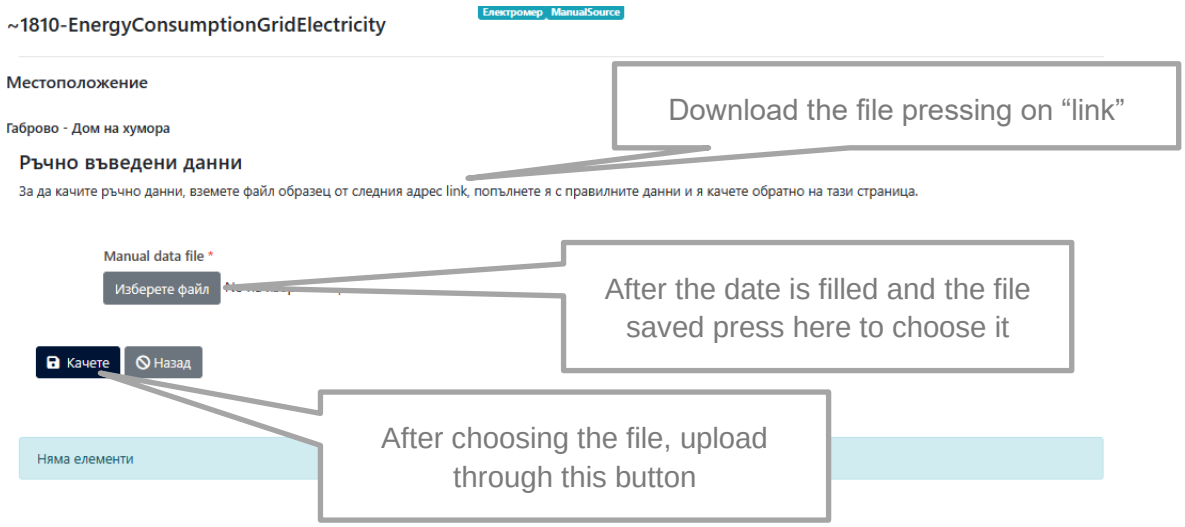
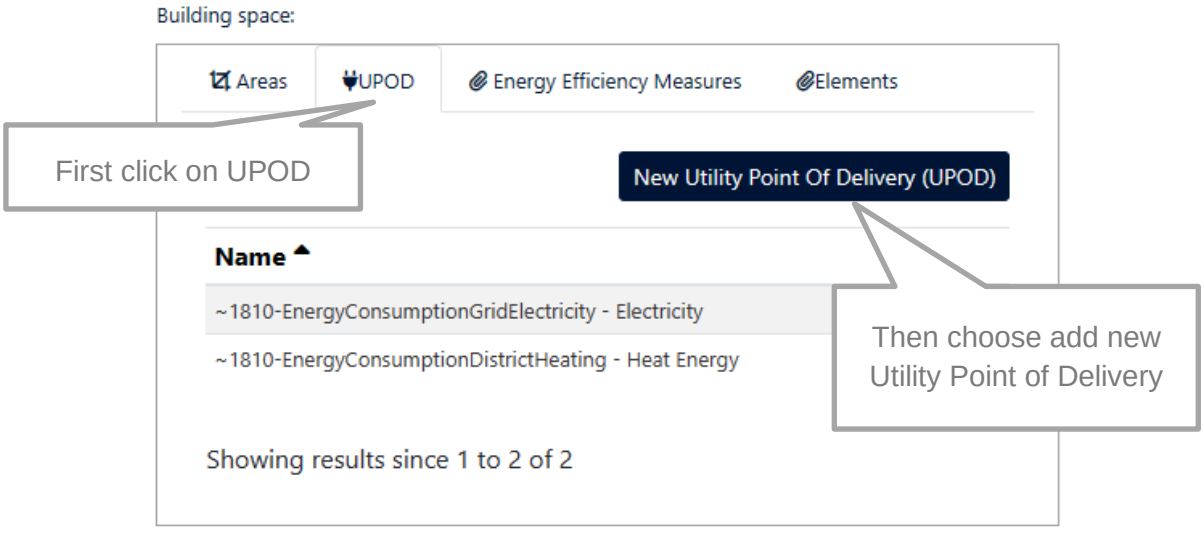


A new window opens:



For Spanish users, some of the necessary data will be generated automatically, without human intervention, using information already available in Datadis system. To use this functionality each building should be linked its relevant Utility Point of Delivery by choosing the following button after opening the building page:



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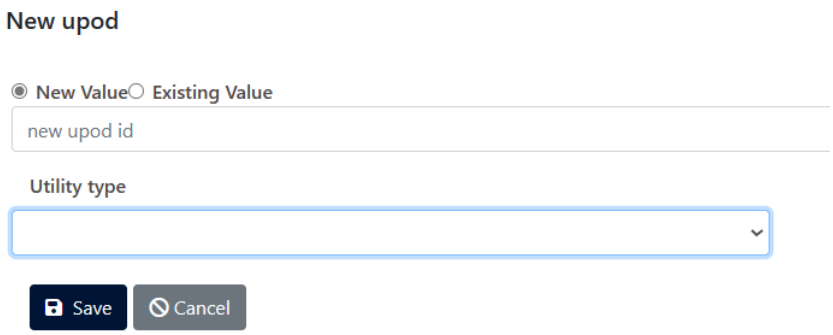
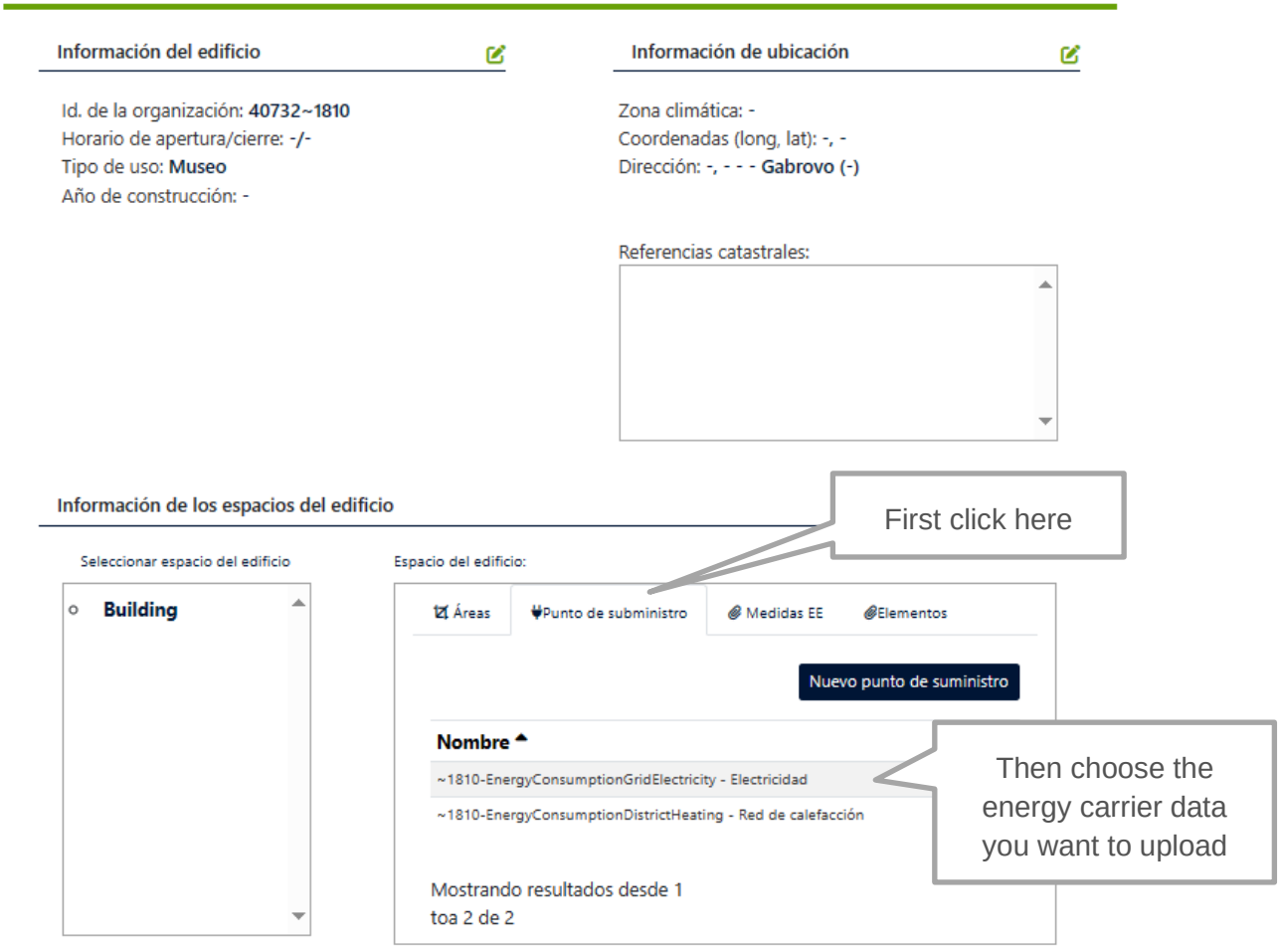
The next screen will allow the user to choose the utility point ID and the utility type (i.e. water, gas, electricity).

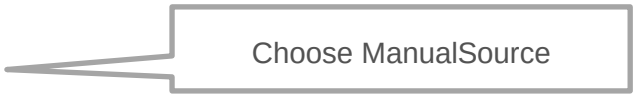


Such a function is not yet available for Bulgarian users as there is no similar service at national level. In the case that a user can provide access to their own energy consumption data (via an appropriate API), the platform developers can easily support them and link each building to the respective data source.

In the case of manual data upload, Spanish users must follow the steps as shown below:



After a new window opens:



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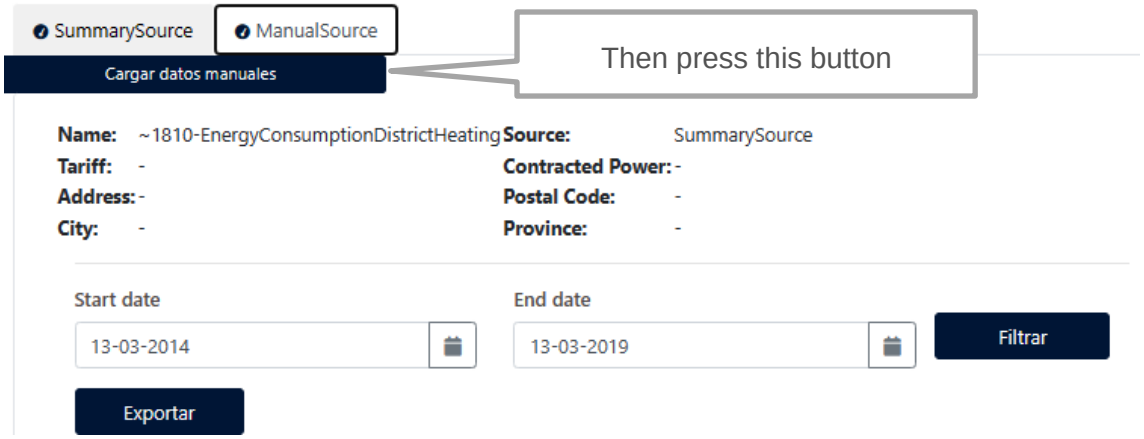
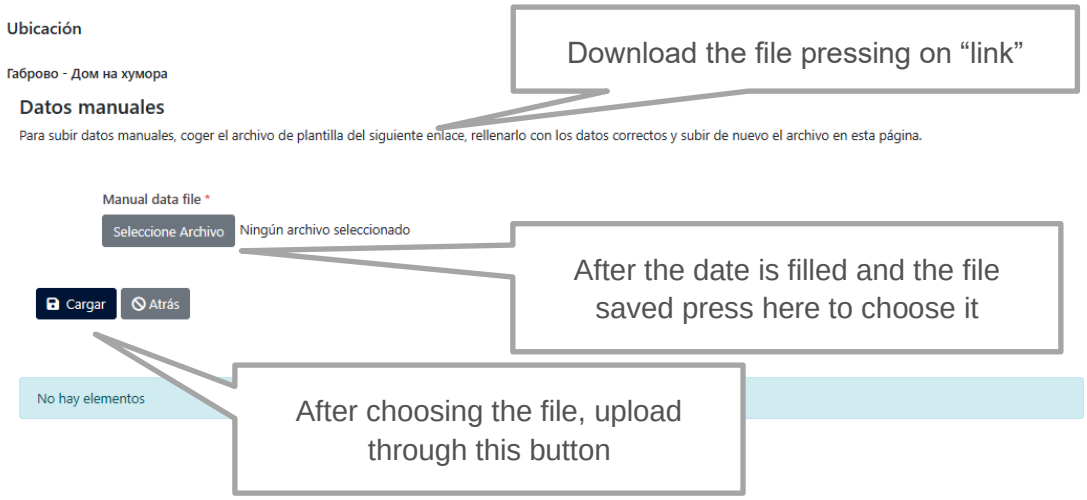


A new window opens:



Minimum, one full year of energy consumption data will be required to include a building in the EN-TRACK database.

6 Understanding the outputs

6.1 Information for all users (incl. not registered)

In order for building owners to work effectively with the platform and make the most of its functionalities, they should be familiar with the indicators it provides. These are conventionally divided into two groups, namely:

- building performance indicators,
- energy efficiency measures (EEM) and energy efficiency investments (EEI) performance indicators.

A summary of the indicators is presented in Table 1 below.

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Overview of the summary indicators for Building Owners & Operators (BO)						
				Energy metrics	**Financial metrics**	**Emissions metrics**
Service categories	Building performance	Cross-sectional benchmarking	consumption-related	kWh/m^2/yr	€/m^2/yr	gCO$_2$/m^2/yr
		Longitudinal benchmarking	consumption-related	kWh	€	gCO$_2$
	EEM performance	Cross-sectional benchmarking	savings-related	kWh/m^2/yr	€/m^2/yr	gCO$_2$/m^2/yr
		Longitudinal benchmarking	savings-related	kWh/m^2	€/m^2	gCO2/m^2
		Cross-sectional benchmarking	avoidance cost		€ cent/kWh	
		Cross-sectional benchmarking	ROI (payback, NPV, IRR)		years, €, %	
		Recommendations	EEMs for specific building characteristics	expected savings kWh/m^2/yr	expected investment €/m^2 savings €/m^2/yr payback years	expected savings gCO$_2$/m^2/yr
		Recommendations	EEMs to achieve target	expected savings kWh/m^2/yr	expected investment €/m^2 savings €/m^2/yr payback years	expected savings gCO$_2$/m^2/yr
		Recommendations	EEMs to prioritise budget	expected savings kWh/m^2/yr	expected investment €/m^2 savings €/m^2/yr payback years	expected savings gCO$_2$/m^2/yr

Table 1: Indicators for BO

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Detailed overview of building performance indicators is as follows:

Indicator	**Energy Use Intensity (EUI) [kWh/m^2/yr]**
Description	Energy Use Intensity (EUI) is an indicator of the energy efficiency of a building's design and/or operation. It is expressed as energy per square meter per year. The EUI includes the overall energy required to operate the building (utility-delivered energy + renewable energy generated and used onsite). Renewable energy exported to the electric grid is not included because it is not used for building operations.
Purpose	EUI is suitable for comparing building energy performance. It is used in a number of different ways including to set a target for energy performance before beginning design, to benchmark a building's designed or operational performance against others of the same building type, or to evaluate compliance against energy code requirements.

Indicator	**Energy Cost Intensity (ECI) [€/m^2/yr]**
Description	Energy Cost Intensity (EUI) is an indicator for the cost of the energy use of a building. It is expressed as Euro per square meter per year. The ECI is based on the overall utility-delivered energy cost, including the paid fixed and variable terms for the billed energy use. The income from the renewable energy exported to the electric grid is subtracted from the utility bills.
Purpose	ECI is suitable for monitoring the energy cost for the use of a building and comparing to other buildings.

Indicator	**Carbon Emissions Intensity (CEI) [gCO_2/m^2/yr]**
Description	Carbon Emission Intensity (CEI) is an indicator of the level of CO_2 emissions associated with the energy use in the building on annual basis. It is expressed as gCO_2 per square meter per year.
Purpose	CEI is suitable for comparing the environmental performance of the building in terms of generated CO_2 emissions.

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Detailed overview of EEM and EEI performance indicators is as follows:

Indicator	**Energy Use Saving Intensity (EUSI) [kWh/m^2/yr]**
Description	Energy Use Saving Intensity (EUSI) is an indicator of the energy saving produced from an EEM on annual basis.
Purpose	EUSI is suitable for comparing the energy saving performance of EEMs implemented in different buildings.

Indicator	**Energy Cost Saving Intensity (ECSI) [€/m^2/yr]**
Description	Energy Cost Saving Intensity (ECSI) is an indicator of the cost saving produced from the EEM on annual basis.
Purpose	ECSI is suitable for comparing the saving performance of EEMs implemented in different buildings in monetary terms.

Indicator	**Emissions Saving Intensity (ESI) [gCO_2/m^2/yr]**
Description	Emissions Saving Intensity (ESI) is an indicator of the emissions reduction produced from the EEM on annual basis.
Purpose	ESI is suitable for comparing the performance of EEMs implemented in different buildings in terms of CO_2 emissions reduction.

Indicator	**Normalised Investment Cost (NIC) [€/m^2]**
Description	Normalised Investment Cost (NIC) is an indicator of the cost of the EEM per square meter of building area.
Purpose	NIC is suitable for comparing the investment of an EEM implemented in different buildings.

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Indicator	Avoidance Cost (AC) [€/kWh]
Description	Avoidance Cost (AC) is the average cost in € for each kWh energy saved over the lifetime of the EEM.
Purpose	AC is suitable for demonstrating how economic benefit of the saved energy when compared to the purchased energy. Avoidance Cost provides the total cost per unit of energy saved by an EEM. When used in conjunction with the value of energy savings, the avoidance cost can provide a net cashflow per unit of energy saved.

Indicator	Simple Payback (SP) [years]
Description	Simple payback time is defined as the number of years required for the money saved by the renovation to cover the investment.
Purpose	This is used to determine whether or not to enter into an investment based on your own investment criteria.

Indicator	Net Present Value (NPV) [€]
Description	Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. It is used to calculate the current total value of a future stream of payments.
Purpose	NPV is used in capital budgeting and investment planning to analyse the profitability of a projected investment or project. If the NPV of a project or investment is positive, it means that the discounted present value of all future cash flows related to that project or investment will be positive, and therefore attractive.

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Indicator	Profitability Index (PI) [-]
Description	The Profitability Index (PI) is the ratio between the present value of future expected cash flows and the initial amount invested in the project.
Purpose	The PI is an appraisal technique commonly applied in project finance. A PI of 1 is the lowest acceptable measure on the index; any value lower than 1 would indicate that the project's present value (PV) is less than the initial investment. A higher PI means that a project will be considered more attractive.

Indicator	Net Present Value Quotient (NPVq) [-]
Description	NPVq is the ratio between the Net Present Value (NPV) and the investment made. It shows what discounted amount is generated against a unit of investment.
Purpose	NPVq allows the revenue that will be obtained from an investment to be estimated. NPVq shows the return, in euros, on a one euro investment. By multiplying the NPVq by the investment you will obtain the revenue from the investment.

Indicator	Internal Rate of Return (IRR) [%]
Description	IRR is a discount rate that makes the net present value (NPV) of all cash flows equal to zero in a discounted cash flow analysis.
Purpose	The internal rate of return (IRR) is a metric used in financial analysis to estimate the profitability of potential investments. The IRR is the annual rate of growth that an investment is expected to generate. The higher an internal rate of return, the more desirable an investment is to undertake. IRR is uniform for investments of varying types and, as such, can be used to rank multiple prospective investments or projects on a relatively even basis. In general, when comparing investment options with other similar characteristics, the investment with the highest IRR probably would be considered the best.

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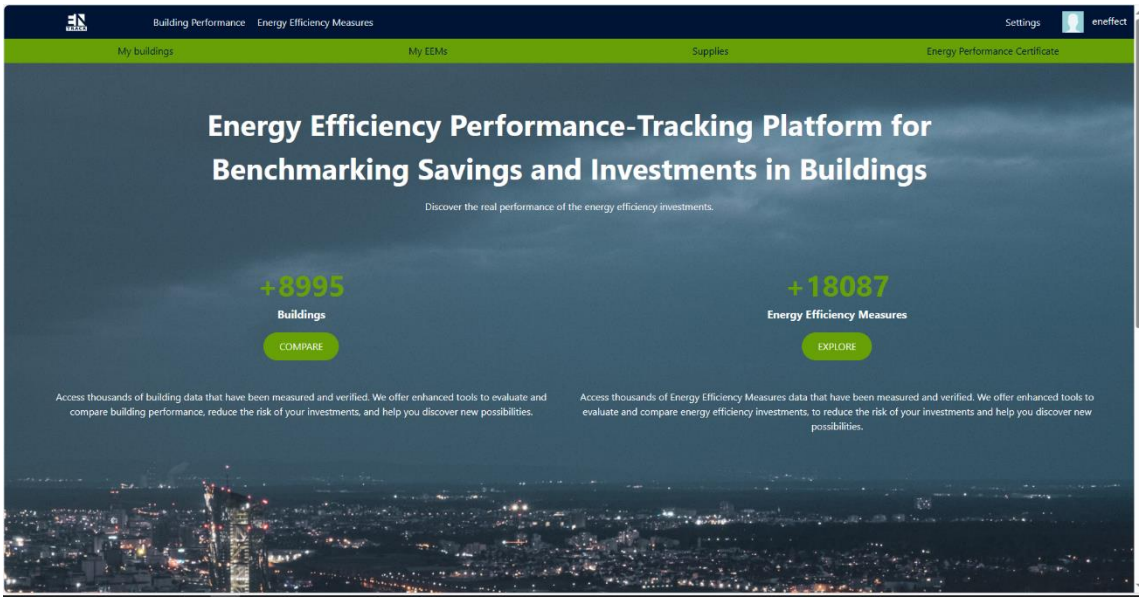
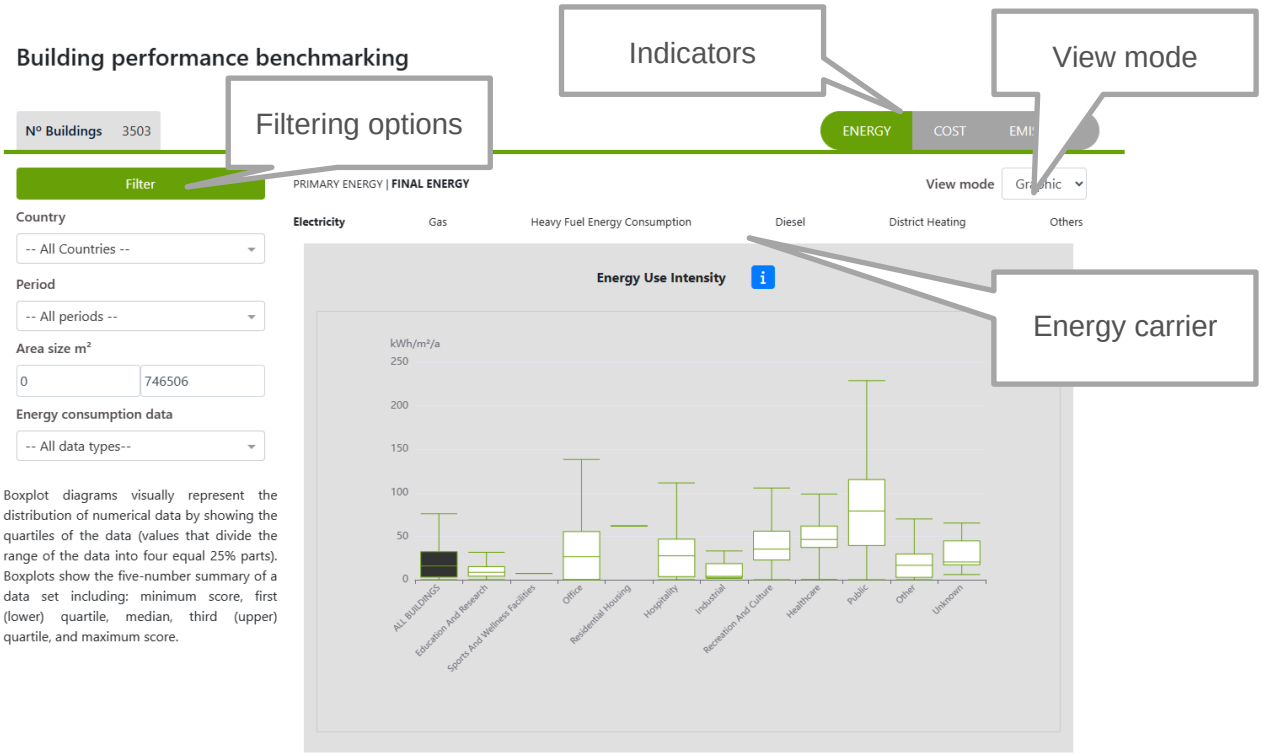
Non-registered users will see the platform landing page (see below) while registered and logged in users can reach this page by pressing the EN-TRACK logo on the top left corner (the green line with the buttons will be visible only for logged in users). There are two main functionalities that can be chosen from here: Compare (Buildings) and Compare (Energy Efficiency Measures).



6.1.1 Building performance benchmarking

The Compare (Buildings) button leads users to the *Building performance benchmarking* page as shown below. Then the user can navigate to the different performance indicators and analytics.



This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.

Filtering options: Allow users to further refine data exploration. There is an option to filter data based on country, time period, area size (measured in square meters), and energy consumption data, which can be either real or normative consumption. This allows the analysis to be customised according to specific criteria and requirements.

Energy carrier: Allow users to compare the indicators by total energy consumption and by different energy carriers (gas, electricity, heat, etc.).

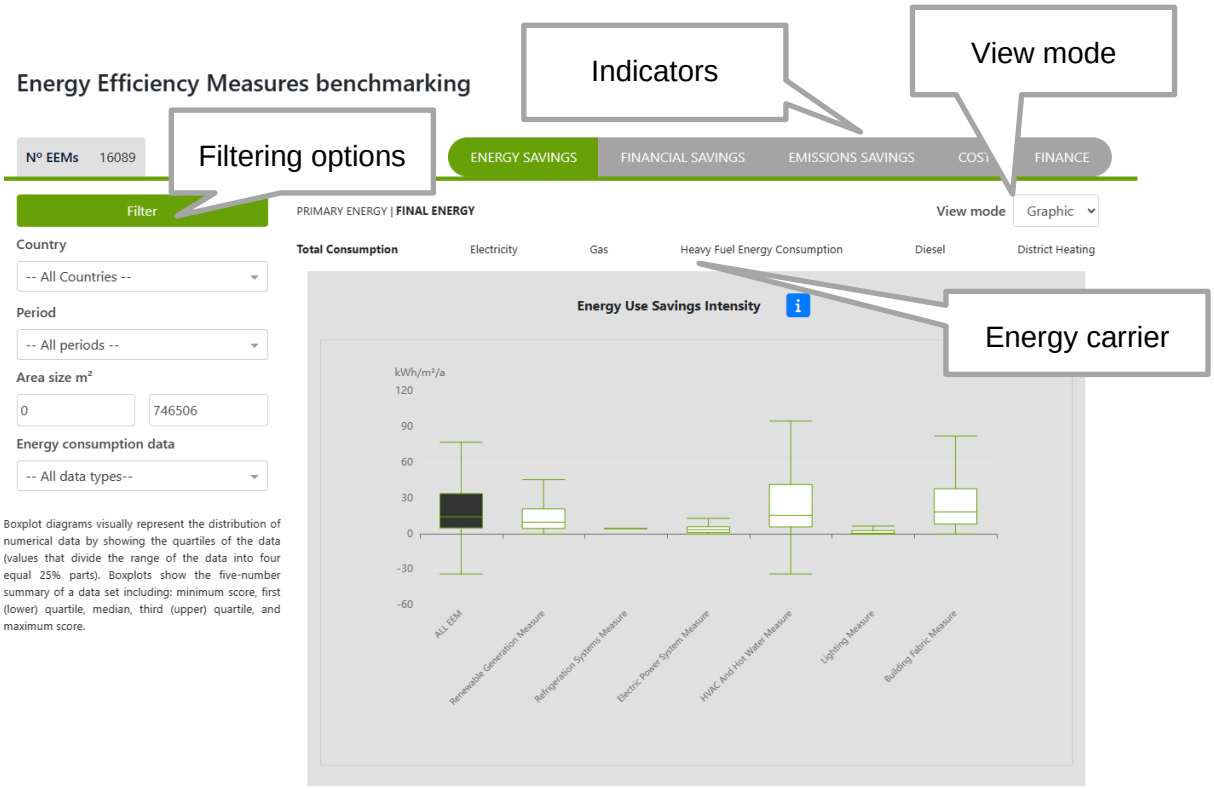
Indicators: User can choose between the three building performance indicators mentioned above (EUI, ECI, CEI).

View mode: User can choose between Boxplot Diagram View or Table View.

Important: Boxplot diagrams offer a visual representation of numerical data by displaying the quartiles of the dataset, dividing the data range into four equal parts of 25%. These diagrams present the following key statistics: minimum score, first quartile, median, third quartile, and maximum score.

6.1.2 Energy efficiency measures benchmarking

The Compare (Energy Efficiency Measures) button leads users to the *Energy efficiency measures benchmarking* page as shown below.



This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.

Filtering options: Allow users to further refine data exploration. There is an option to filter data based on country, time period, area size (measured in square meters), and energy consumption data, which can be either real or normative consumption. This allows to to customise the analysis according to specific criteria and requirements.

Energy carrier: Allow users to compare the indicators by total energy consumption and by different energy carriers (gas, electricity, heat, etc.).

Indicators: User can choose between the three building performance indicators mentioned above (EUSI, ECSI, EESI, NIC, AC, IRR, NPV, NPVq, SP, PI).

View mode: User can choose between Boxplot Diagram View or Table View.

6.2 Information for registered users (data providers)

Only registered users who provide data will have access to the features described in this section. The landing page of the platform is shown below, and users can navigate through the different sub-pages by the buttons on the green line:

My building

My EEMs

Supplies

Energy Performance Certificates

The **Settings** button is in the top left corner of the screen.

6.2.1 My buildings

The button leads the users to the following page:

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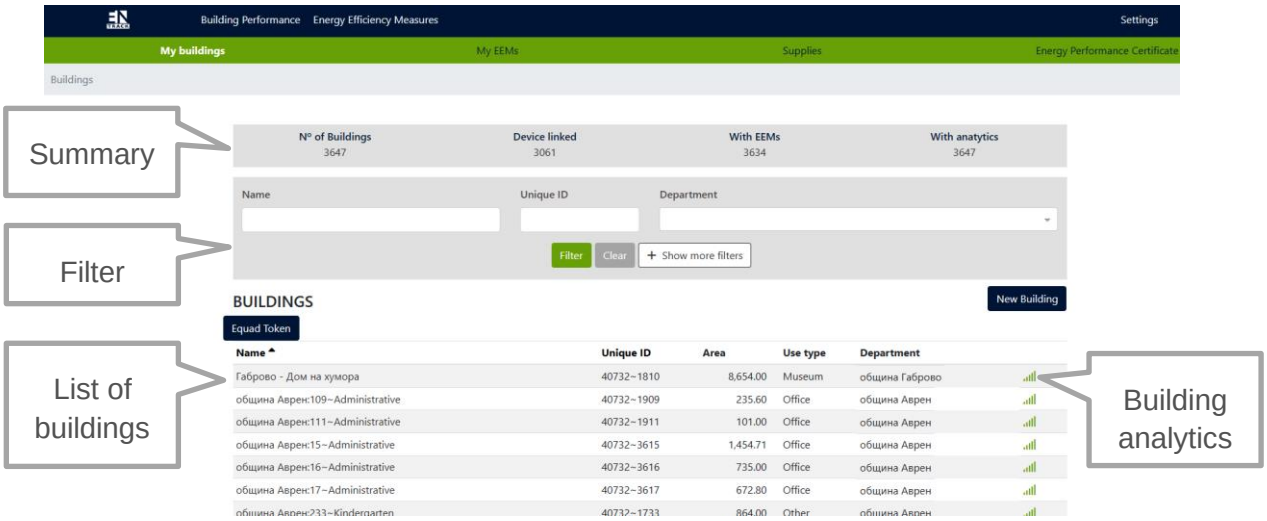
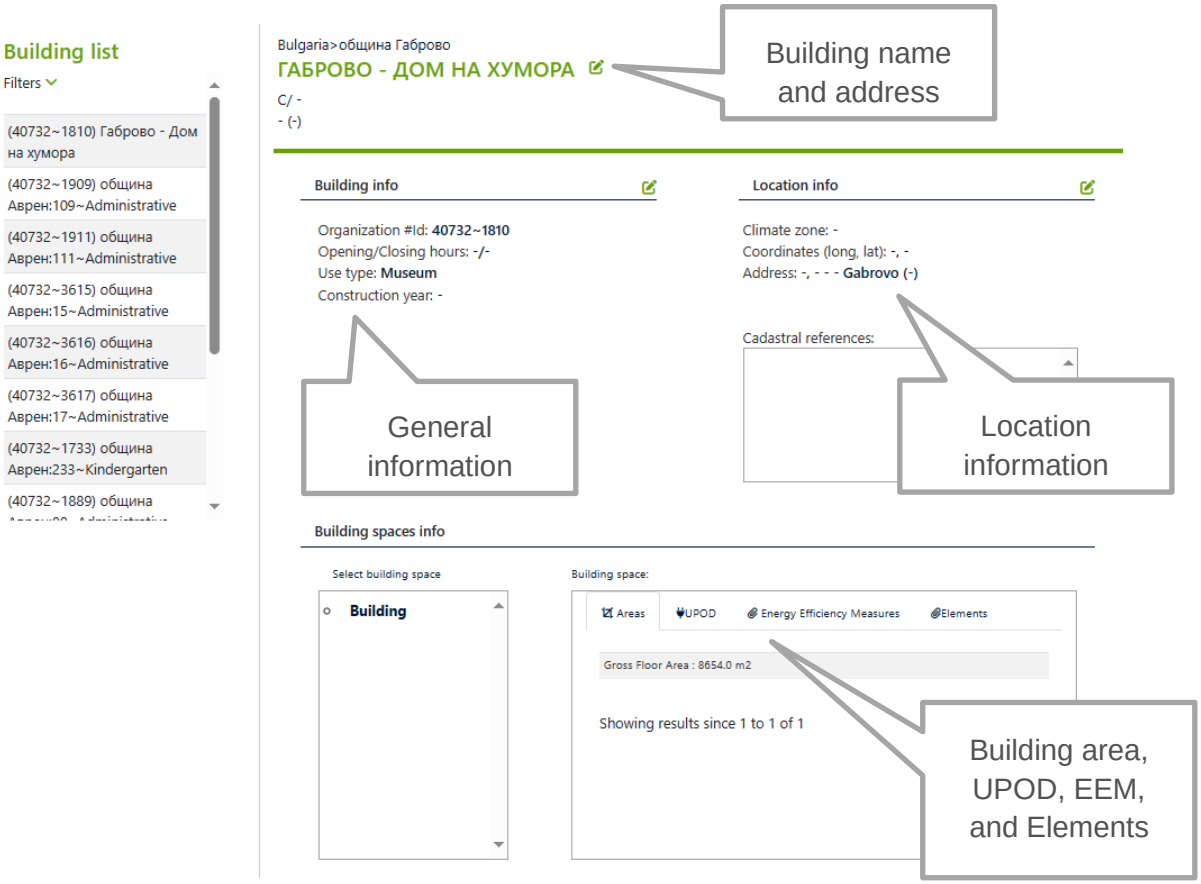


Choosing a building, the user will be redirected to its specific page where all available information for the site is available.



Energy data can be imported through the UPOD button (see chapter 5, Provision of data). The Energy Saving Measures button, allow the users to input data for implemented energy measures as follows:

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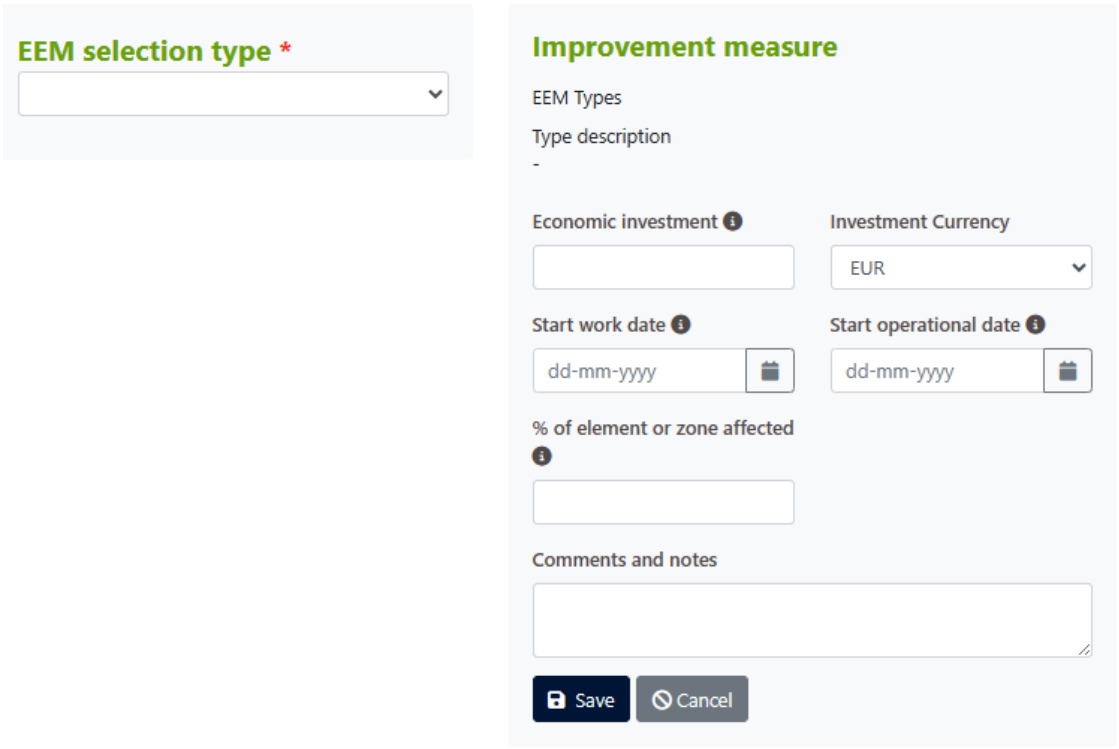
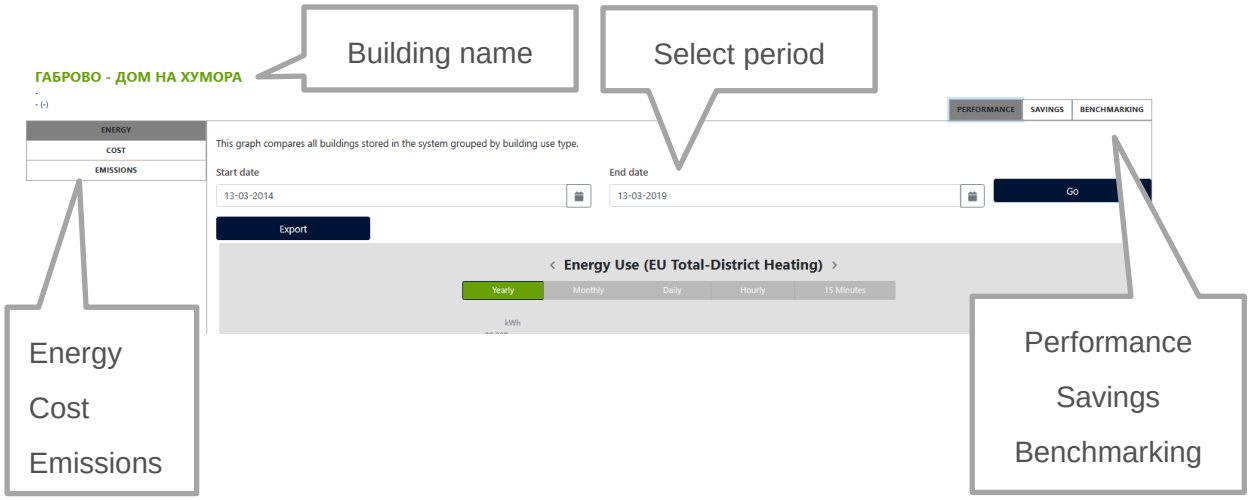


Choosing the Building analytics (see above) redirects the user to the main performance indicators and benchmarking data.



From this page the user can compare the main performance indicators of the building with all other buildings stored in the system and grouped by building type use as shown below.

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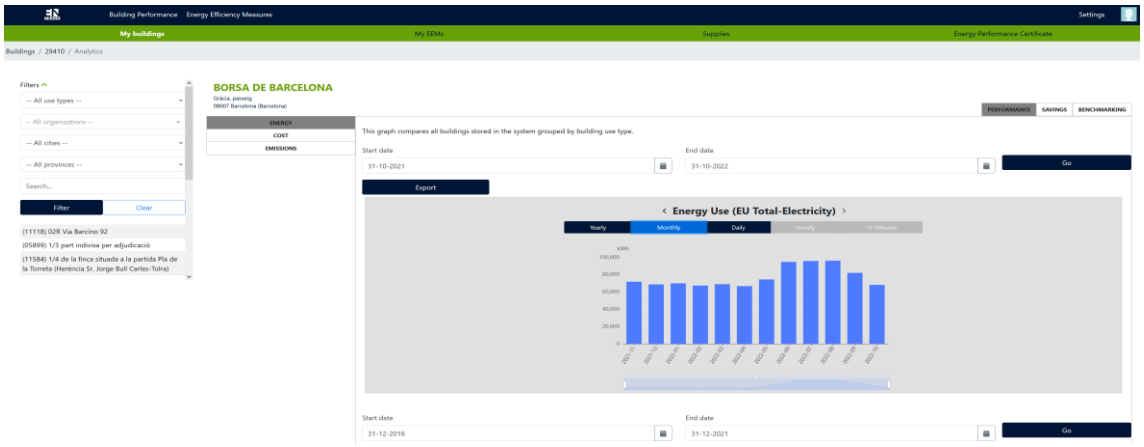
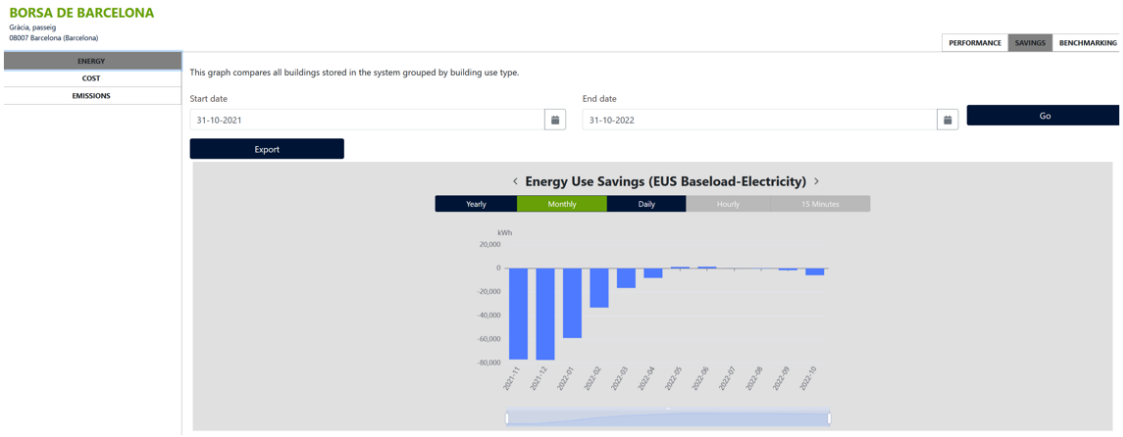
Energy performance on yearly, monthly, daily, hourly and 15 min base:



Energy savings:



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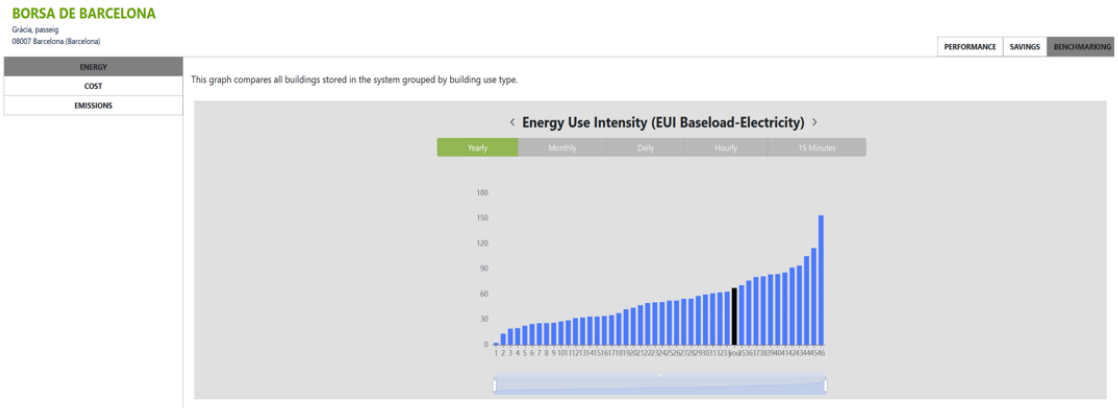
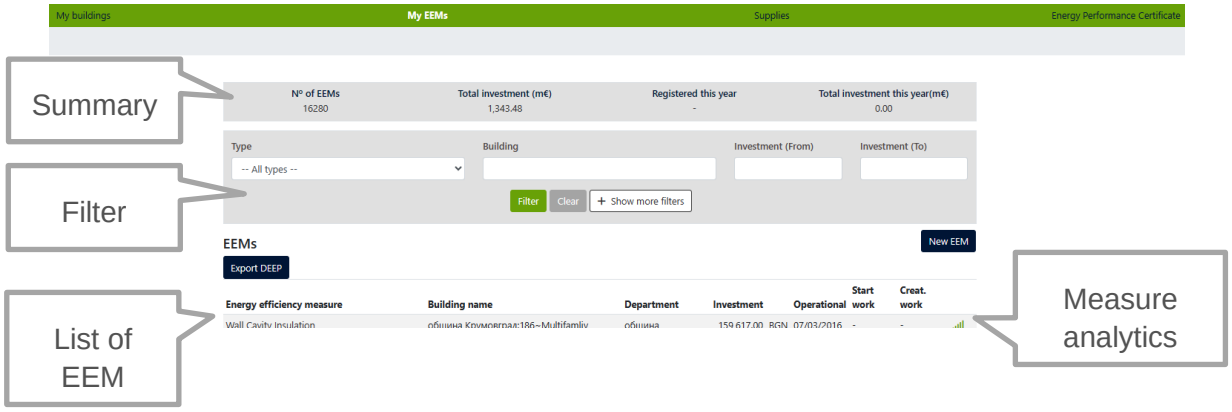
Benchmarking:



The more detailed the data is available for a building, the more detailed the information that will be generated by the platform.

6.2.2 My EEMs

This button redirects the user to the list of implemented energy measures as follows:



The user can then either choose a measure from the list or can measure analytics.

Choosing a measure from the list redirects the user to its specific page, where all available information will be shown.

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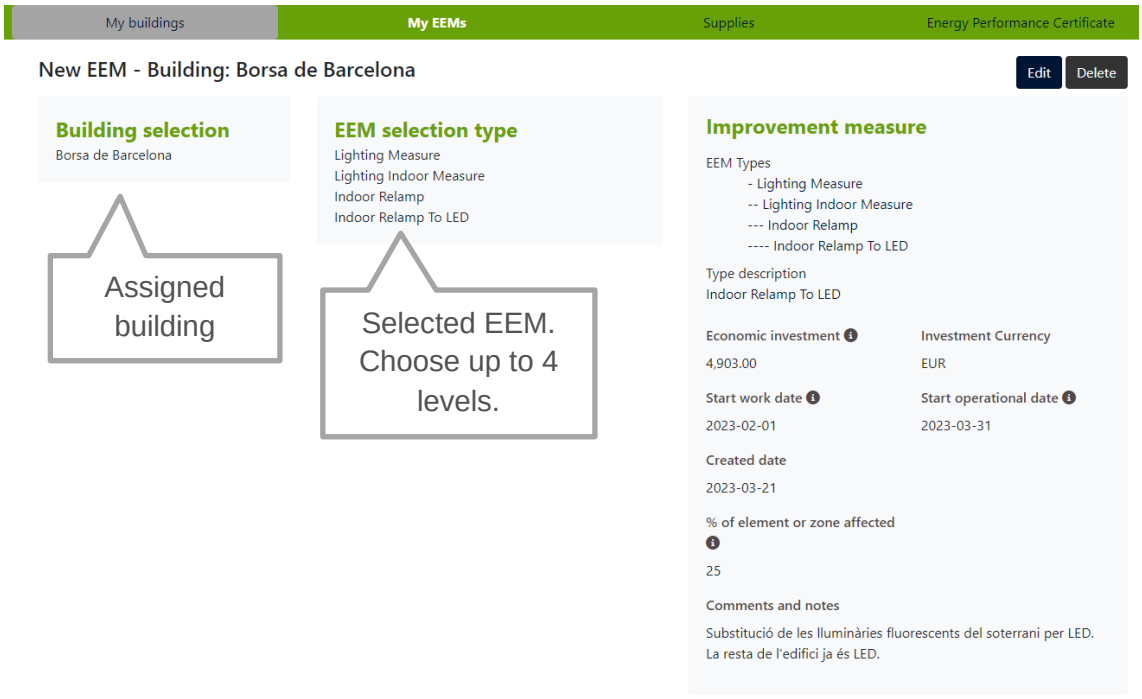
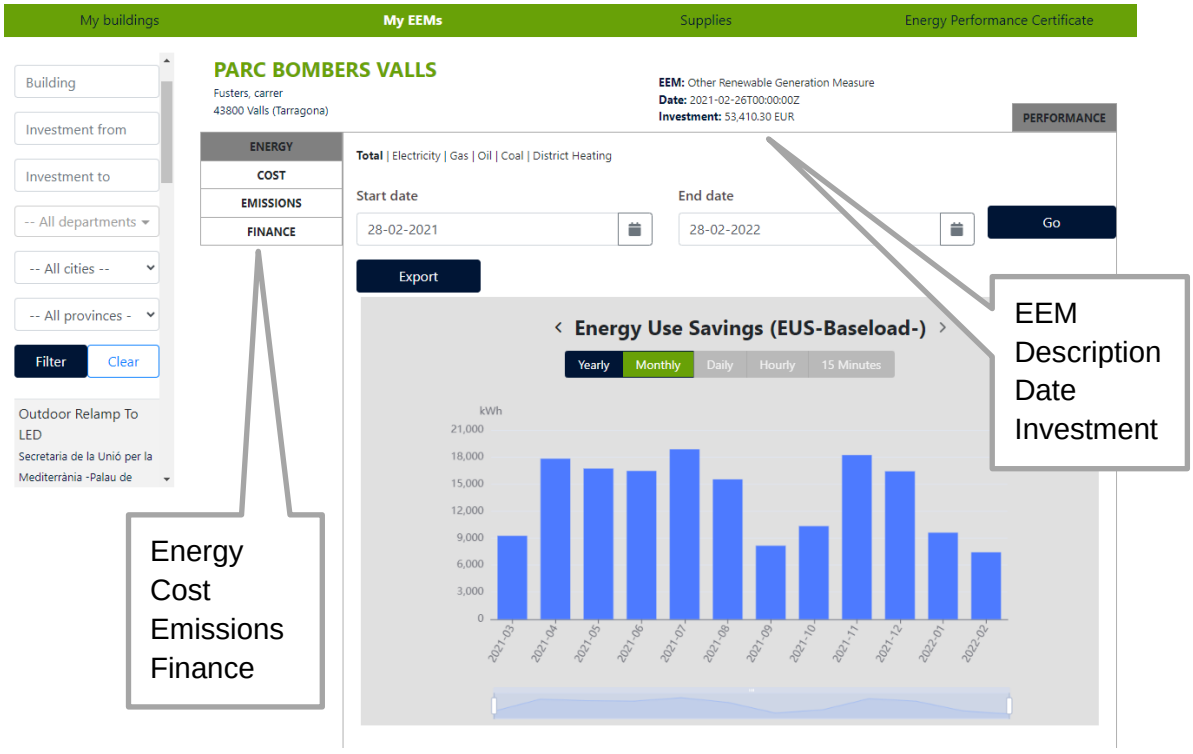


Choosing to measure analytics (see above) redirects the user to the main performance indicators and benchmarking data.



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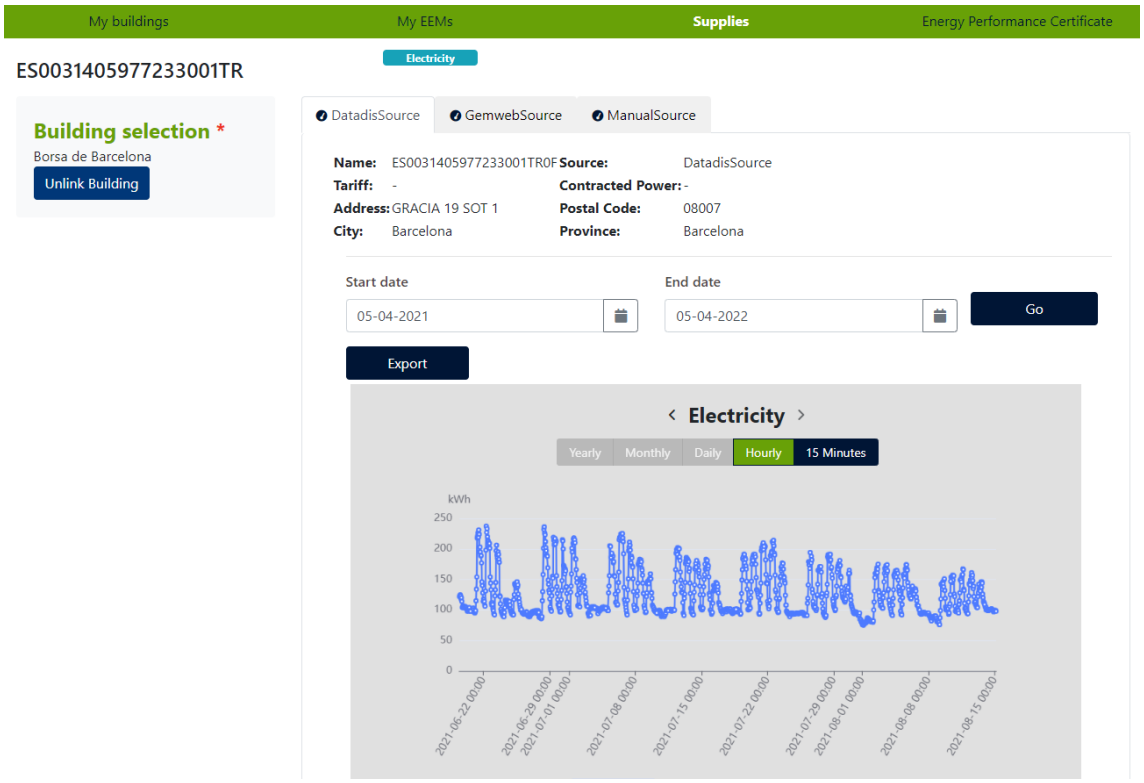
From this page the user can analyse the effect of the measure (if data about energy consumption before and after the measure is imported) by energy, cost, and emission savings as well see the financial parameters.

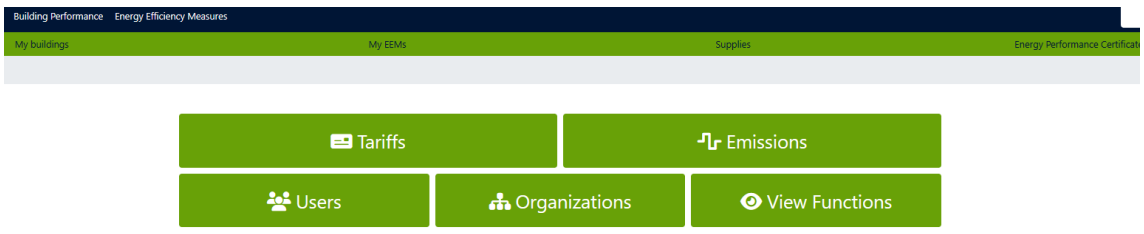
6.2.3 Supplies

This button refers to the measuring devices linked to the building (see section 5 – Provision of data). Each building can include several energy supplies and the user can choose any specific energy carrier to review the histogram of the readings. As mentioned above this functionality is currently working for the Spanish pilot (see below).



6.2.4 Settings

The Settings button allow users to manage organisation profile and users, as well as emission factors and energy tariffs.



The users hierarchy is described in chapter 4 Registration and settings.

Users management:

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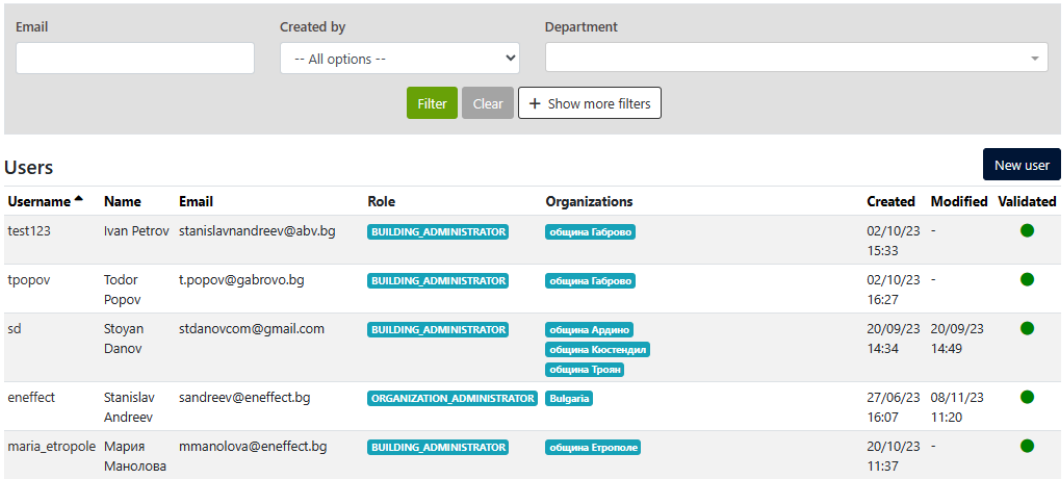
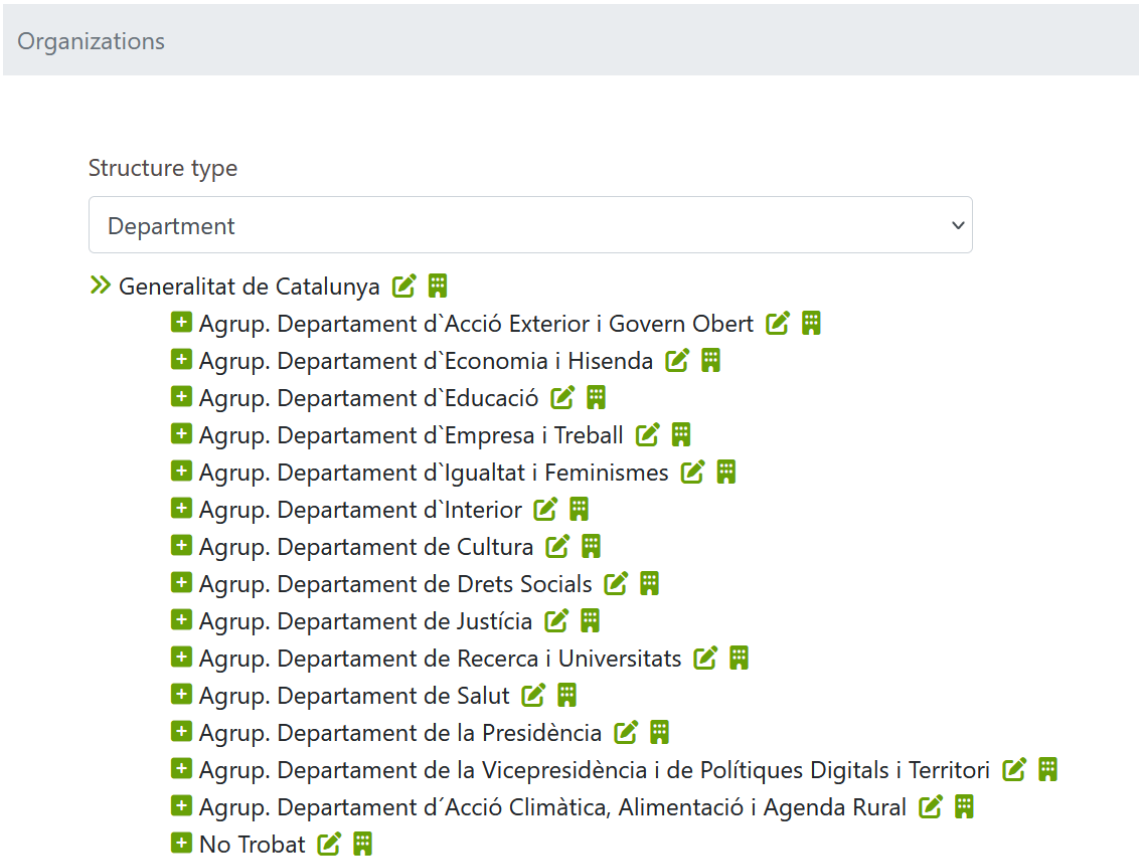


Organisation management:



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7 Using the outputs

The results of the platform can be used at all stages in the process of improving the energy performance of buildings - from identifying problems and appropriate measures to attracting investment and verifying results.

7.1 Identify projects/measures

Taking a closer look at the energy planning process reveals that the fundamental action is the creation of an information database. This enables municipal management and municipal officials to focus their efforts to improve energy efficiency in the right direction. Whether we are talking about initiatives such as the Covenant of Mayors and the European Energy Awards, energy management standards such as ISO 50001, or energy planning methodologies such as MODEL, the planning process starts only after we have gathered primary information. This is exactly one of the main functions of EN-TRACK platform – a suitable tool for creation of initial database.

However, it should be noted that such a database alone is not sufficient to enable energy management and planning processes. A database alone does not include information about the energy efficiency potential and does not automatically rate the possible EEI. This requires further analyses and information processing. In other words, a database alone does not directly help to attract investment and specify the exact parameters of potential projects. Indirectly, of course, the existence and maintenance of such a database creates confidence in the financing institutions because it shows the commitment of the organisation to monitor its energy consumption as well as the ability to verify the energy savings achieved. Considering the above, and also the main stages of the planning process (Plan-Do-Check-Act), it can be said that EN-TRACK is a tool that goes beyond what is currently available. On the one hand, it offers post-processing of primary information that will facilitate more informed decision making by BO on future interventions thus leading to more effective management to maintain and improve condition of the building stock. On the other hand, the platform will also support users by contributing to better identification of EEM on all levels. These levels are specified below:

Energy controlling: Investment is limited to providing human resources to collect and monitor energy consumption, detect energy losses (e.g. unexpected peaks in consumption, weekend consumption) and take adequate action (e.g. instructions to staff, emergency repairs) to minimise them. This should be part of the job description of Building Operators and the Energy Management team in the organisation.

Operation optimisation: Additional resources should be added to the above to analyse data in more detail and identify opportunities to optimise the operation of building systems and building use modes (e.g. heating scheduling, demand control) to reduce energy consumption. More qualified experts and sometimes external expertise is also needed to identify measures and support municipal management to implement them.

Investment measures - More resources are needed as well as external expertise to identify measures (e.g. insulation, windows replacement, new building systems) and secure funding for their implementation.

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Cost-benefit-ratio of the above listed measures are as follows [3], [4]:

- Energy controlling: savings potential > 5%; cost-benefit-ratio 1:5 to 1:10
- Operation optimisation: savings potential > 15%; cost-benefit-ratio 1:3 to 1:5
- Investment measures: savings potential > 30%; cost-benefit-ratio 1:1 to 1:2

7.2 Attract funding

Large-scale action to improve the energy efficiency of the building stock is by no means within the power of any one organisation without attracting external funding. However, to attract such funding, specific projects with good financial performance must be identified, and this always involves additional costs for energy audits, feasibility studies and/or design. Even in this case, financial institutions are not always ready to support the projects as a matter of priority, as they lack capacity in the field of energy efficiency and do not realise that these are low-risk projects with high replication potential. Here again, the EN-TRACK platform can be relied on, as its huge database contains thousands of real examples of already implemented projects which are expected to create confidence and change the approach of financial institutions towards building renovation. Outputs from the platform can be used as a basis for communication with commercial banks, specialised funders and ESCO companies in order to negotiate better financing terms.

7.3 Verify savings

A crucial phase in energy management and planning is the monitoring and verification of the results achieved. Very often the expected/calculated savings from the implementation of energy efficiency measures are not achieved and this can be due to many factors (contractor errors, wrong conditions set by the contracting authority, incorrect use of new equipment, etc.). In such cases, the municipality's energy management team or building operators have the key role as they are supposed to first identify non-compliance, find the cause and ultimately take corrective action to extract the maximum potential from the investments made. This is where EN-TRACK's platform comes in again. Based on analysis of the data provided on the energy efficiency measures implemented and the energy consumption, the EN-TRACK platform allows users to identify any non-compliance within a short time of project completion.

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.

8 References and resources

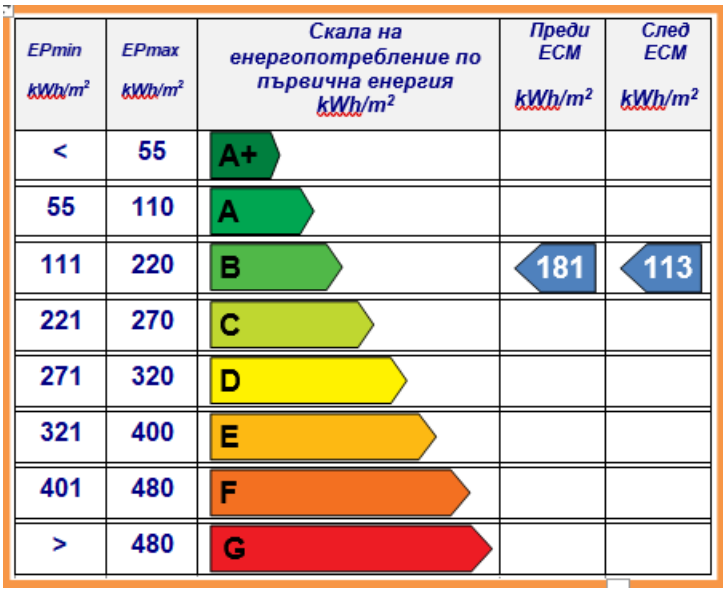
1) EN-TRACK overall requirements and data model, 2021 https://zenodo.org/record/5148241#.Y846tEFByUl
2) Municipal energy planning, guide for municipal decision makers and experts, EnEffect, 2010, http://eneffect.com/images/upload/Temi/Policy/mep_guide_eng_small.pdf
3) Finus, O: Das (Durch)StarterPaket, StarterMaßnahmen für das Handlungsfeld 1: Energiee-insparung, kommunales Energiemanagement [Coaching Municipal Climate Action: The Start-er Package, Starter Measures for Action Field 1: Energy Saving, Municipal Energy Manage-ment], 2015. Available online under: https://www.coaching-klimaschutz.de/fileadmin/inhalte/Dokumente/StarterSet/Coaching_DurchStarterPaket_1_Energiemanagement.pdf, last access October 2023.
4) Schrade, J; Pimenta, D: Municipal energy planning and energy management experience in Germany, 2020. Available online under: https://www.eneffect.bg/images/upload/123/Presentations/EUKI_Analytical_report_Fraunhofer_IBP_20200821web_MEMS.pdf, last access October 2023.

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.

Appendix A: Sources of general building data (Bulgaria)

Energy performance certificate

The EPC shows the current energy class of the building and the expected energy class after implementation of recommended measures.



EPmin kWh/m²	EPmax kWh/m²	Скала на енергопотребление по първична енергия kWh/m²	Преди ECM kWh/m²	След ECM kWh/m²
<	55	A+		
55	110	A		
111	220	B	181	113
221	270	C		
271	320	D		
321	400	E		
401	480	F		
>	480	G		

It also includes the characteristics of the building envelope. The yellow column shows the reference values that can easily be compared with the current values, so we can see which building elements needs improvement.

ОГРАЖДАЩИ КОНСТРУКЦИИ И ЕЛЕМЕНТИ

Наименование	Площ	[2] Коефициент на топлопреминаване		
		Референ-тен	Преди ECM	След ECM
-	m²	W/m².K	W/m².K	W/m².K
Стени (външни)	1381,40	0,28	1,36	0,28
Прозорци (външни)	248,99	1,40	2,47	2,47
Прозорци на покрива	X	X	X	X
Врати (външни)	23,67	2,20	3,19	3,19
Покрив	762,86	0,30	1,19	0,11
Под	681,19	0,45	0,46	0,40

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Information about the efficiency of the building systems is also available.

ПОКАЗАТЕЛИ НА ЕНЕРГОПРЕОБРАЗУВАЩИТЕ СИСТЕМИ В СГРАДАТА

1. Показатели за технологичните процеси на отопление и вентилация			2. Ефективност на генератора на топлина, %		
Показател	Преди ECM	След ECM	Преди ECM	След ECM	[1] Норма
Инсталирана мощност за отопление, kW	550	550	100	100	...
	...	...	...	...	...
Ефективност на рекуперацията на топлина при вентилация, %			55	55	$\eta_{рек} \geq 70$ %
			...	...	$\eta_{рек} \geq ...$ %

3. Ефективност на генератора на студ (включително термопомпа с приложение за отопление)			
Показател	Преди ECM	След ECM	[2] Норма за възобновяема енергия
Коефициент на трансформация при генерирането на топлина	2,6	2,6	SCOP ≥ 3,50
	...	...	...
Коефициент на трансформация при генерирането на студ	2,6	2,6	
	...	...	
4. Енергия от възобновяеми източници	..... MWh	27,2 MWh	

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Energy audit summary

General information about the building from the standardised summary.

ВИД ПО ПРЕДНАЗНАЧЕНИЕ:		Сграда в областта на културата и изкуството	
Сграда/ Част от сграда			
КЛАС НА ЕНЕРГОПОТРЕБЛЕНИЕ		**ПРЕДИ ЕСМ**	**СЛЕД ЕСМ**
		C	*B*
СПЕЦИФИЧЕН РАЗХОД НА ЕНЕРГИЯ, kWh/m².год.		*862,3*	*187,9*
ВИД СОБСТВЕНОСТ		…….	
СОБСТВЕНИК НА СГРАДАТА, *(адрес, телефон, e-mail)*		…….	
ИДЕНТИФИКАТОР (съгласно ЗКИР)		…….	
МЕСТОПОЛОЖЕНИЕ	АДМИНИСТРАТИВНА ОБЛАСТ	…….	
	ОБЩИНА	…….	
	НАСЕЛЕНО МЯСТО И АДРЕС	…….	
ГОДИНА НА ВЪВЕЖДАНЕ В ЕКСПЛОАТАЦИЯ		*1989*	
ЗАСТРОЕНА ПЛОЩ, m²		*578*	
РАЗГЪНАТА ЗАСТРОЕНА ПЛОЩ, m²		*899*	
ОТОПЛЯЕМА ПЛОЩ, m²		*899*	
ОТОПЛЯЕМ ОБЕМ , m³		*2222*	
ПЛОЩ НА ОХЛАЖДАНИЯ ОБЕМ, m²		*899*	
ОХЛАЖДАН ОБЕМ, m³		*2222*	
БРОЙ ЕТАЖИ	НАДЗЕМНИ / ПОДЗЕМНИ*	*1*	1
БРОЙ ОБИТАТЕЛИ		*31*	

The energy balance of the building is also presented in the standardised summary. It usually includes the current values, the normalised values, and the expected values after implementation of EEM.

№	СИСТЕМА, СЪОРЪЖЕНИЕ	ГОДИШЕН РАЗХОД НА ЕНЕРГИЯ КЪМ МОМЕНТА НА ОБСЛЕДВАНЕТО		НОРМАЛИЗИРАН ГОДИШЕН РАЗХОД НА ЕНЕРГИЯ		ПРОГНОЗИРАН РАЗХОД НА ЕНЕРГИЯ СЛЕД ИЗПЪЛНЕНИЕ НА ЕСМ	
		специфичен	общ	специфичен	общ	специфичен	общ
		kWh/m²	kWh	kWh/m²	kWh	kWh/m²	kWh
1	ОТОПЛЕНИЕ	0,0	0	180,7	283 914	6,7	10 472
2	ВЕНТИЛАЦИЯ	0,0	0	21,5	33 713	1,6	2 528
3	БГВ	0,0	0	8,5	13 359	8,5	13 359
4	ВЕНТИЛАТОРИ, ПОМПИ	0,0	0	3,1	4 872	4,1	6 515
5	ОСВЕТЛЕНИЕ	0,0	0	6,6	10 436	2,6	4 047
6	УРЕДИ	0,0	0	10,8	17 001	5,7	9 026
7	ОХЛАЖДАНЕ	0,0	0	2,9	4 560	2,6	4 020
	ОБЩО:	**0,00**	**0**	**234,15**	**367 854**	**31,81**	**49 967**

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The Summary also includes information about the recommended measures including investment costs, expected savings and emission reduction.

МЕРКИ		ЕНЕРГИЯ		СПЕСТЕНИ ГОРИВА И ЕНЕРГИЯ				НЕОБХОДИМИ ИНВЕСТИЦИИ	СРОК НА ОТКУПУВАНЕ	СПЕСТЕНИ ЕМИСИИ CO_2
№	НАИМЕНОВАНИЕ	№	ЕНЕРГИЕН РЕСУРС	t/год.	Nm^3/год.	kWh/год.	лв./год.	лв.	год.	t/год.
Група В: Енергоспестяващи мерки за подобряване на енергийните характеристики на ограждащите конструкции и елементи										
1	Топлинно изолиране на външни стени	1	МАЗУТ							
		2	ДИЗЕЛОВО ГОРИВО	4,26		50 096	8 558	75 159	9	13
		3	ПРОПАН-БУТАН							
		4	ПРОМИШЛЕН ГАЗЬОЛ							
		5	ПРИРОДЕН ГАЗ							
		6	ВЪГЛИЩА							
		7	ПЕЛЕТИ							
		8	ДЪРВА ЗА ОГРЕВ							
		9	ДРУГИ *(изписва се)*							
		10	ТОПЛИННА ЕНЕРГИЯ							
		11	ЕЛЕКТРИЧЕСКА ЕНЕРГИЯ							
		ОБЩО МЯРКА 1					**8 558**	**75 159**	9	**13**

In case there are multiple measures proposed the Summary gives information about the overall project savings and investments.

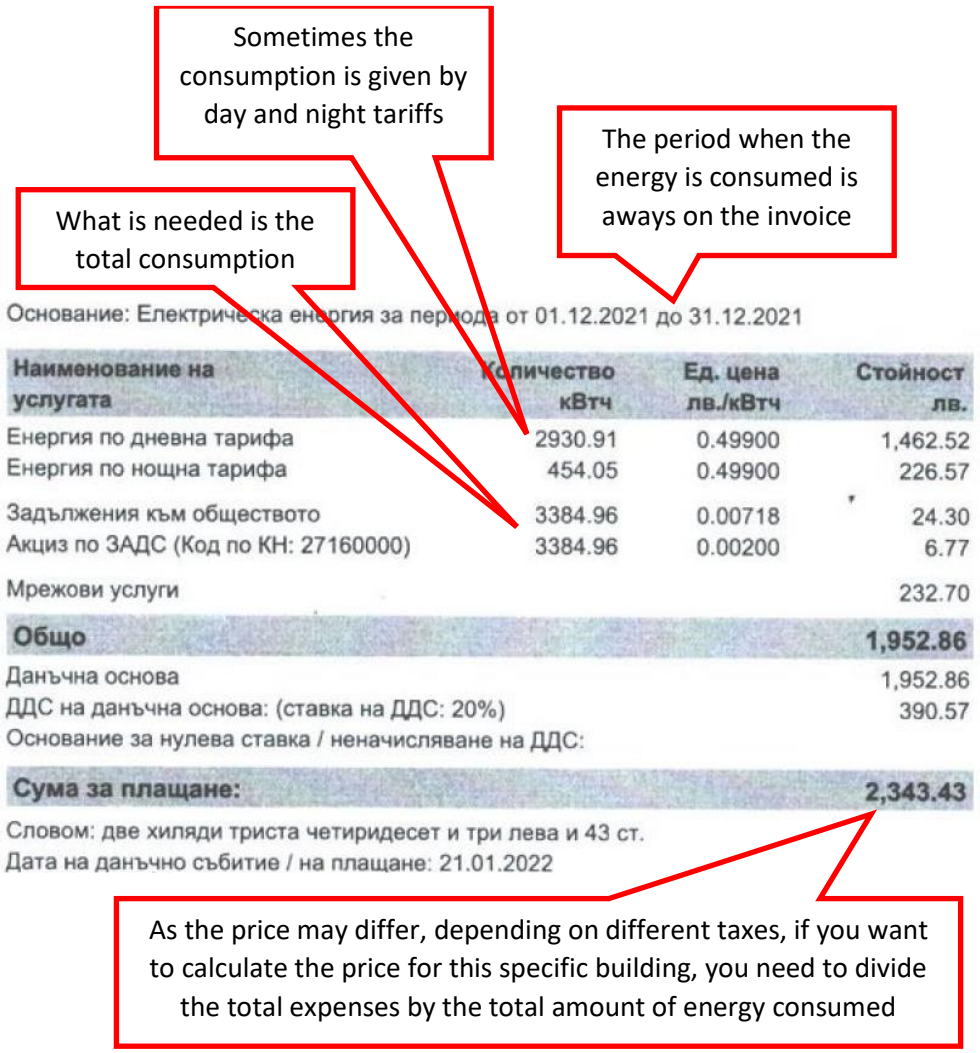
МЕРКИ		ЕНЕРГИЯ		СПЕСТЕНИ ГОРИВА И ЕНЕРГИЯ				НЕОБХОДИМИ ИНВЕСТИЦИИ	СРОК НА ОТКУПУВАНЕ	РЕДУЦИРАНИ ЕМИСИИ CO_2
П2		№	ЕНЕРГИЕН РЕСУРС	t/год.	Nm^3/год.	kWh/год.	лв./год.	лв.	год.	t/год.
12	**ОБЩО ГОДИШНО СПЕСТЯВАНЕ НА ЕНЕРГИЯ СЛЕД ИЗПЪЛНЕНИЕ НА ВСИЧКИ ЕСМ ОТ ИЗБРАНИЯ ПАКЕТ**	1	МАЗУТ	0	0	0	0	0		0
		2	ДИЗЕЛОВО ГОРИВО	17	0	200 148	34 191	198 966	6	53
		3	ПРОПАН-БУТАН	0	0	0	0	0		0
		4	ПРОМИШЛЕН ГАЗЬОЛ	0	0	0	0	0		0
		5	ПРИРОДЕН ГАЗ	0	-9 383	-87 259	-6 544	0	0	-18
		6	ВЪГЛИЩА	0	0	0	0	0		0
		7	ПЕЛЕТИ	0	0	0	0	0		0
		8	ДЪРВА ЗА ОГРЕВ	0	0	0	0	0		0
		9	ДРУГИ *(изписва се)*	0	0	0	0	0		0
		10	ТОПЛИННА ЕНЕРГИЯ	0	0	0	0	0		0
		11	ЕЛЕКТРИЧЕСКА ЕНЕРГИЯ	0	0	0	0	0		0
		ВСИЧКО:				***112 889***	***27 647***	***198 966***	*7*	***36***

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.

Appendix B: Energy data sources (Bulgaria)

Electricity invoices

The Electricity invoice provides the energy consumed in kWh (sometimes in MWh), for a certain period (usually a month) and the cost of the energy.

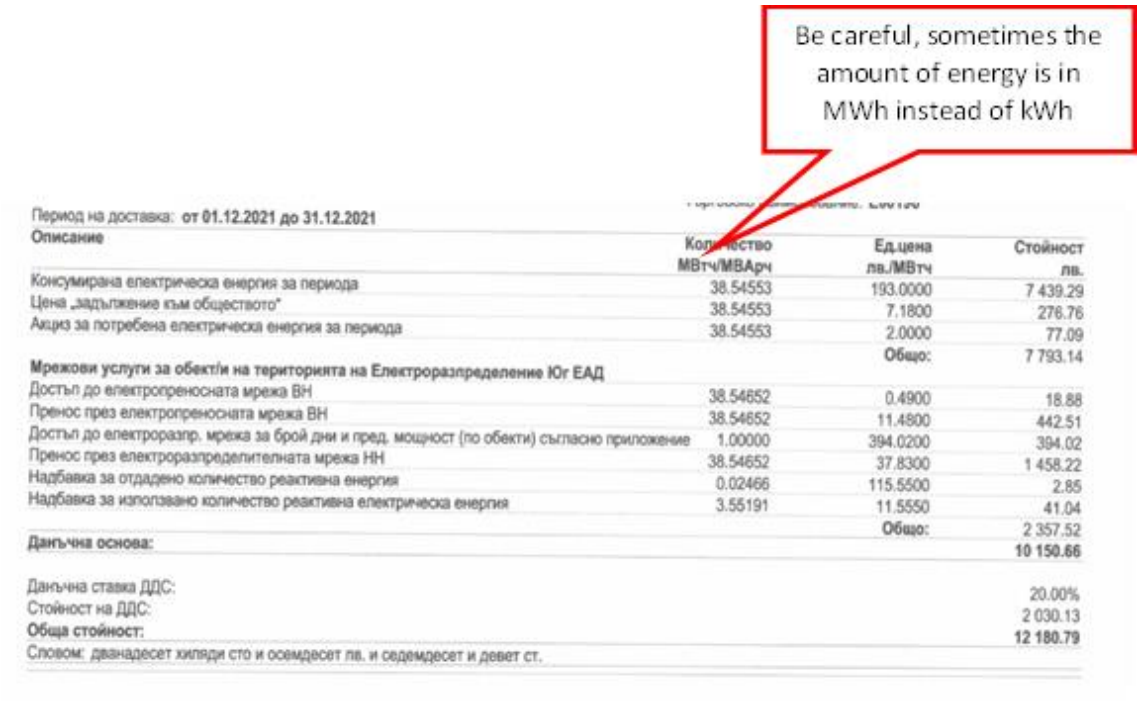


Основание: Електрическа енергия за периода от 01.12.2021 до 31.12.2021

Наименование на услугата	Количество кВтч	Ед. цена лв./кВтч	Стойност лв.
Енергия по дневна тарифа	2930.91	0.49900	1,462.52
Енергия по нощна тарифа	454.05	0.49900	226.57
Задължения към обществото	3384.96	0.00718	24.30
Акциз по ЗАДС (Код по КН: 27160000)	3384.96	0.00200	6.77
Мрежови услуги			232.70
Общо			**1,952.86**
Данъчна основа			1,952.86
ДДС на данъчна основа: (ставка на ДДС: 20%)			390.57
Основание за нулева ставка / неначисляване на ДДС:			
Сума за плащане:			**2,343.43**

Словом: две хиляди триста четиридесет и три лева и 43 ст.
Дата на данъчно събитие / на плащане: 21.01.2022

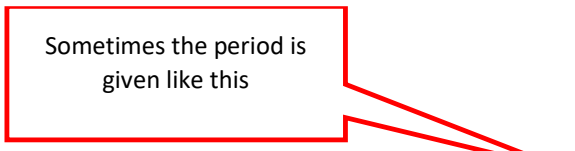
This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.



Период на доставка: **от 01.12.2021 до 31.12.2021**

Описание	Количество МВтч/МВАрч	Ед.цена лв./МВтч	Стойност лв.
Консумирана електрическа енергия за периода	38.54553	193.0000	7 439.29
Цена „задължение към обществото"	38.54553	7.1800	276.76
Акциз за потребена електрическа енергия за периода	38.54553	2.0000	77.09
		Общо:	7 793.14
Мрежови услуги за обект/и на територията на Електроразпределение Юг ЕАД			
Достъп до електропреносната мрежа ВН	38.54652	0.4900	18.88
Пренос през електропреносната мрежа ВН	38.54652	11.4800	442.51
Достъп до електроразпр. мрежа за брой дни и пред. мощност (по обекти) съгласно приложение	1.00000	394.0200	394.02
Пренос през електроразпределителната мрежа НН	38.54652	37.8300	1 458.22
Надбавка за отдадено количество реактивна енергия	0.02466	115.5500	2.85
Надбавка за използвано количество реактивна електрическа енергия	3.55191	11.5550	41.04
		Общо:	2 357.52
Данъчна основа:			**10 150.66**
Данъчна ставка ДДС:			20.00%
Стойност на ДДС:			2 030.13
Обща стойност:			**12 180.79**

Словом: дванадесет хиляди сто и осемдесет лв. и седемдесет и девет ст.



Основание: Електрическа енергия за месец декември 2021

Наименование на услугата	Количество кВтч	Ед. цена лв./кВтч	Стойност лв.
Електрическа енергия	7106.00	0.51489	3,658.79
Задължения към обществото	7106.00	0.00718	51.02
Акциз по ЗАДС (Код по КН: 27160000)	7106.00	0.00200	14.21
Мрежови услуги			464.96
Общо			**4,188.98**
Данъчна основа			4,188.98
ДДС на данъчна основа: (ставка на ДДС: 20%)			837.80
Основание за нулева ставка / неначисляване на ДДС:			
Сума за плащане:			**5,026.78**

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.

Natural gas invoices

Sometimes you may have advanced payments, the accurate data is the final invoice for the month

Наименование на стоката / услугата	Мярка	Количество	Един.цена(лв.)	Стойност(лв.)
Разпределение на природен газ по договор № [redacted] Декември 2021	MWh	14.364000	25.68	368.87
Снабдяване с природен газ по договор № [redacted] за Декември 2021	MWh	13.059060	0.79	10.32
Доставка на природен газ по договор № [redacted] за Декември 2021	MWh	13.059060	102.33	1336.33
Пренос през газопреносната мрежа			0.70	9.09
Достъп до газопреносната мрежа			3.44	44.90
Акциз ставка в лв: 0.60 лв	GJO	46.9779	0.60	28.19
Приспаднат аванс от ф-ра [redacted]			-297.35	-297.35
Приспаднат аванс от ф-ра [redacted]			-1500.35	-1500.35

For reporting purposes, you will need the amount of energy and it is always in MWh

Разходомер №	Старо	Ново	Коефициент на коригиране	Коригирано количество	Коефициент на преобразуване в енергийни единици (1)	Количество енергия
[redacted]	101757	102996	1.000	1.239 x 1000m3	10.540kWh/m3	13.059060 MWh

Sometimes period looks like this

Amount of energy in MWh

No	Предмет на стопанската операция: Код	Предмет на стопанската операция: Наименование	Мярка	Количество	Единична цена (без ДДС)	стойност (без ДДС)	ДДС %
1		Природен газ разпределение 01.12.2021 - 31.12.2021	MWh	26.255	20.7300	544.27	20
2		Природен газ снабдяване 01.12.2021 - 31.12.2021	MWh	26.255	0.4400	11.55	20
3		Природен газ на общ. доставчик 01.12.2021 - 31.12.2021	MWh	26.255	102.3300	2,686.68	20
4		Прогнозна цена за пренос ГПМ 01.12.2021 - 31.12.2021	MWh	26.255	0.6963	18.28	20
5		Прогнозна цена за достъп ГПМ 01.12.2021 - 31.12.2021	MWh	26.255	3.1180	81.86	20
6		Акциз 01.12.2021 - 31.12.2021	GJ	94.521	0.6000	56.71	20
7		Кор. ДОСТ 01.11.21-30.11.21 26.063400MWh			3.1180	-81.27	20
8		Деб ДОСТ 01.11.21-30.11.21 26.063400MWh			3.5161	91.64	20

You do not need the among of gas as caloricity may differ

ПОКАЗАНИЯ НА РАЗХОДОМЕРА

Дата	Вид Показание	Показание на разходомера	Разлика(хнм3)	Показание на коректора	Разлика(хнм3)
30.11.2021	Старо показание	162.750		3.011	
31.12.2021	Засичане от инкасатор	165.032	2.282	5.502	2.491

Реална консумация в хиляди куб. метри: 2.491

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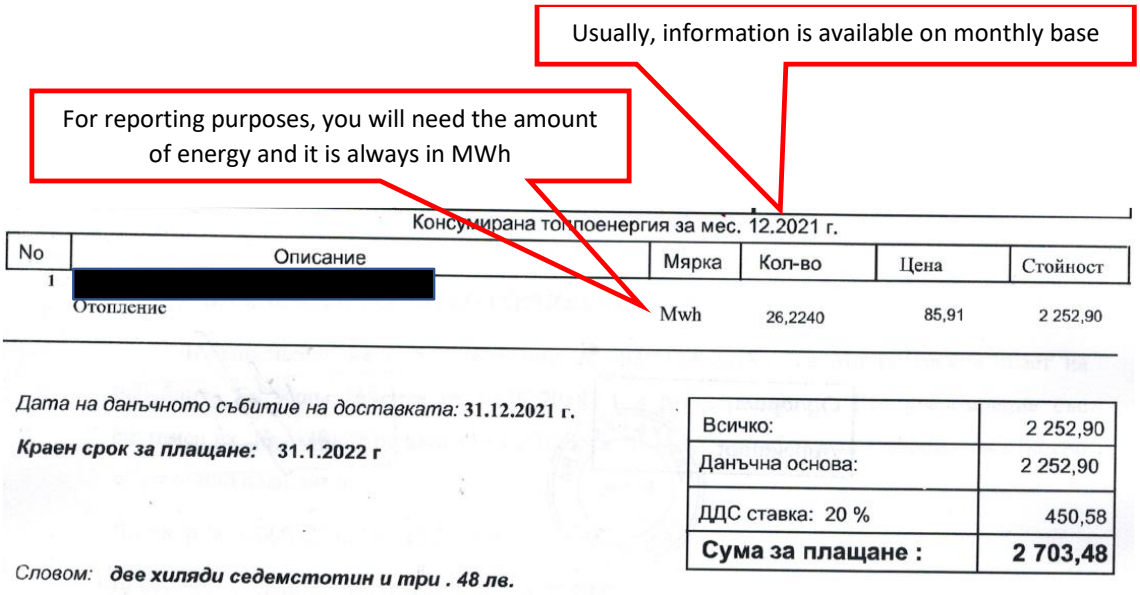
District heating invoices

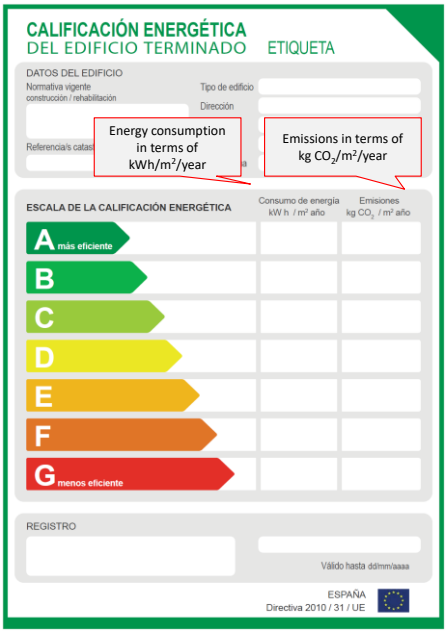


This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.

Appendix C: Sources of general building data (Spain)

Energy performance certificate

The EPC label describes the energy qualification of any building based on two criteria, energy consumed (kWh/m^2/year) and CO_2 emissions (kg CO_2/m^2/year).



The label is obtained after performing an analysis of the building, focusing on the equipment used, their efficiency and also the energy source they use. The label is accompanied with the results of the analysis in a report, some pictures of the kind of information provided for the report can be seen below.

First the analysis must differentiate if the building is a dwelling (domestic use) or a tertiary building (public or private). Tertiary sector buildings are subject to a more extensive analysis compared to domestic sector buildings.

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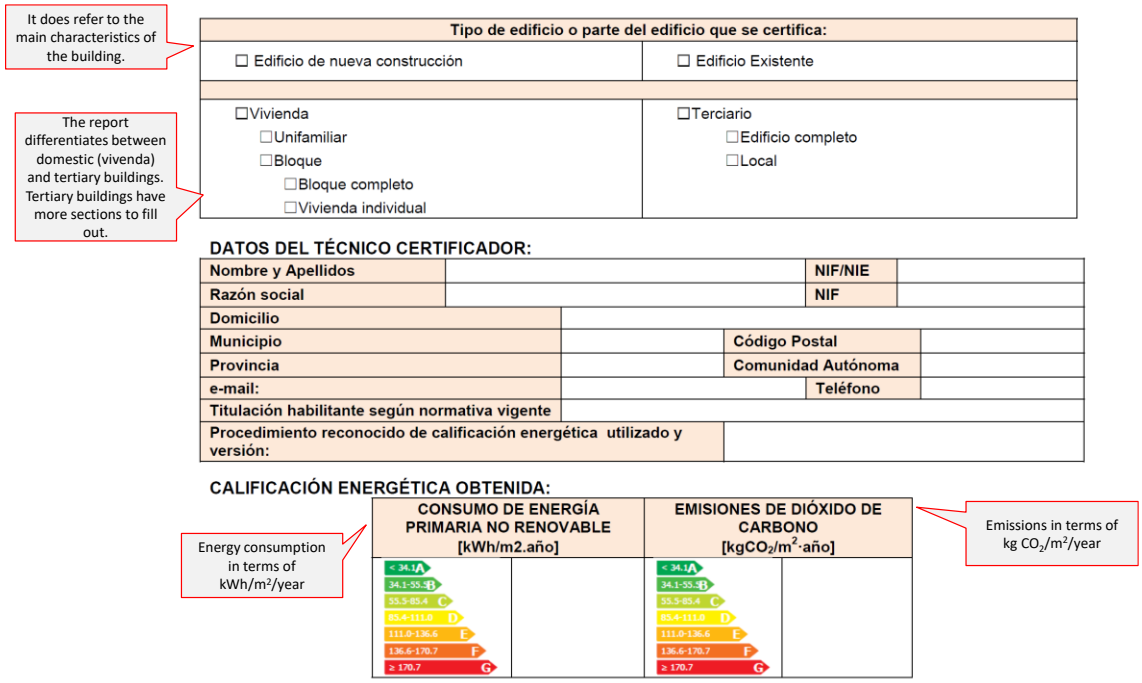
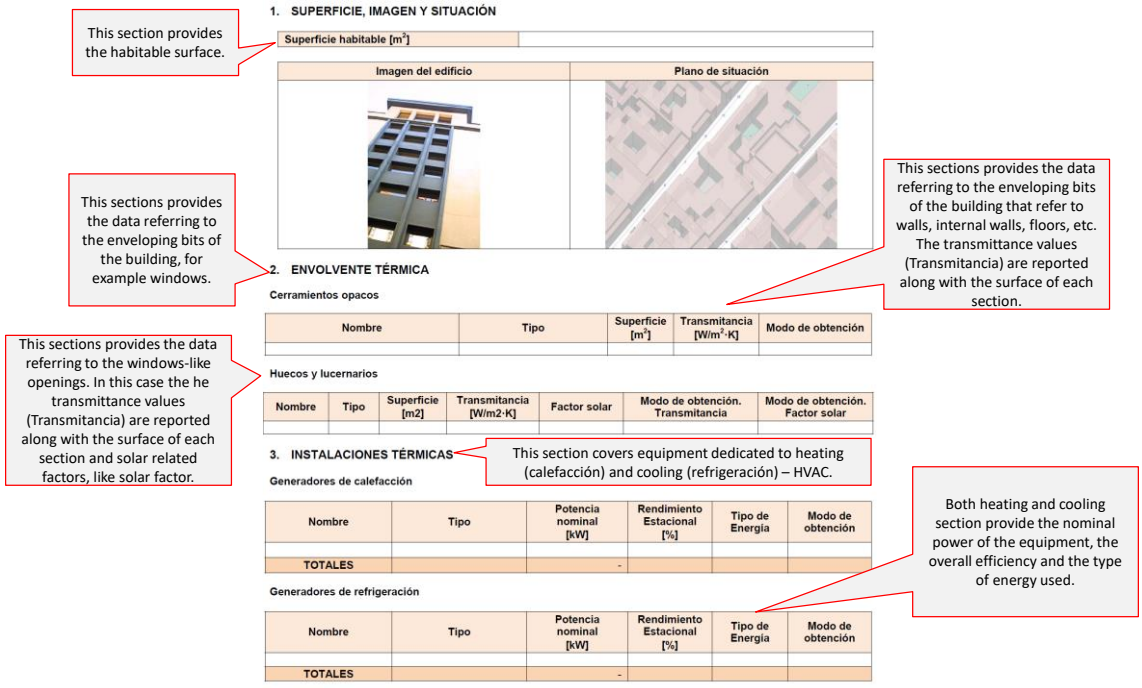


A common set of information for all buildings is the total surface of the building. Another set of common information is the building envelope properties. This is used to determine energy loses and solar gains. It provides the surface and transmittance of all envelope components, and the solar gains for windows. HVAC installations are also required for all types of buildings, their section provides the information for the types of equipment, their efficiency and the requirement for hot water (see following picture).



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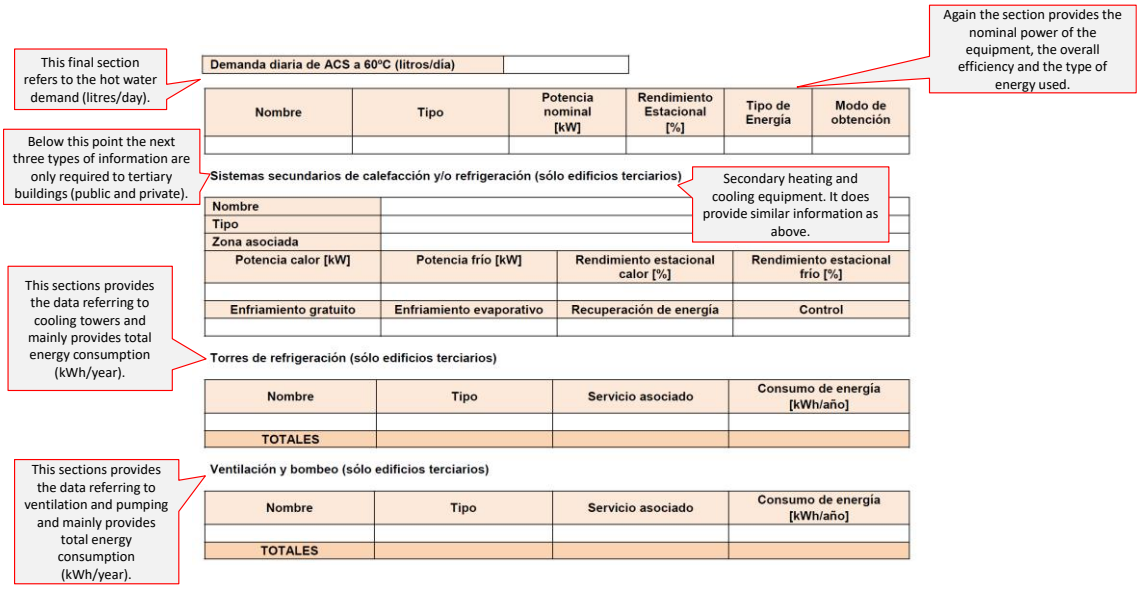
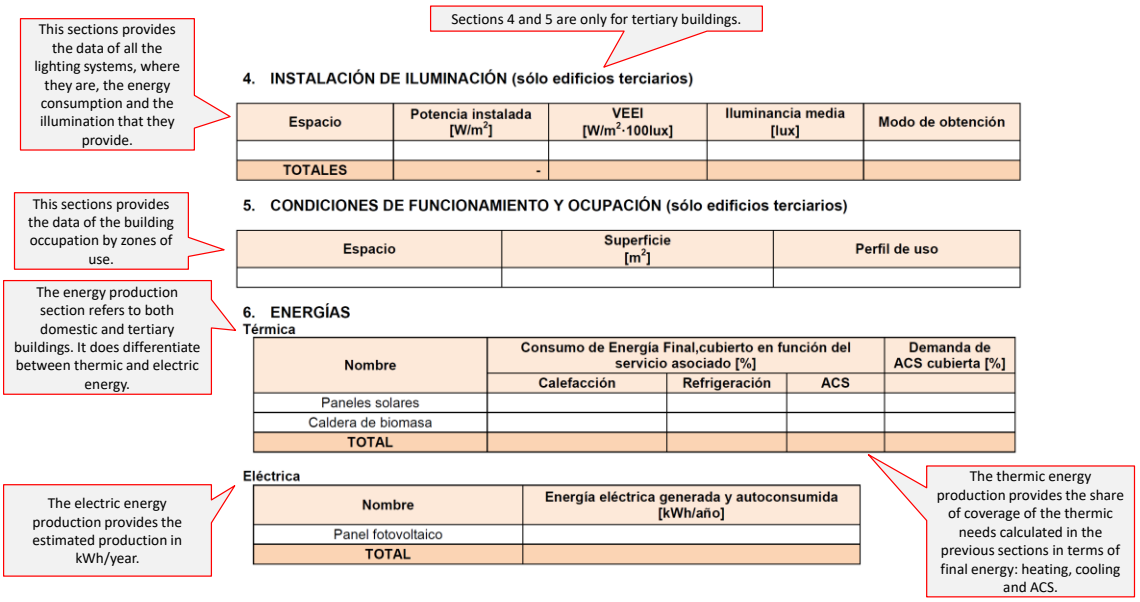
The thermal installations have expanded requirements for tertiary buildings, which include secondary HVAC systems, cooling towers and the ventilation and pumping systems. They provide information about the type of equipment, the energy consumption and the equipment efficiency (only for secondary HVAC)



The lighting systems and building occupation are also required for tertiary buildings. The lighting systems provide the location of the several installations, their power and the expected illumination. The occupation information determines the profile of user of each section of the building, and the available surface.

The final section, types of energy used is common for all buildings. It does provide information of the sources for the thermic energy, and how each source will cover the thermic demand based on the different equipment's efficiency. The electrical energy section measures the amount of energy production using solar PV panels (assuming there is any).



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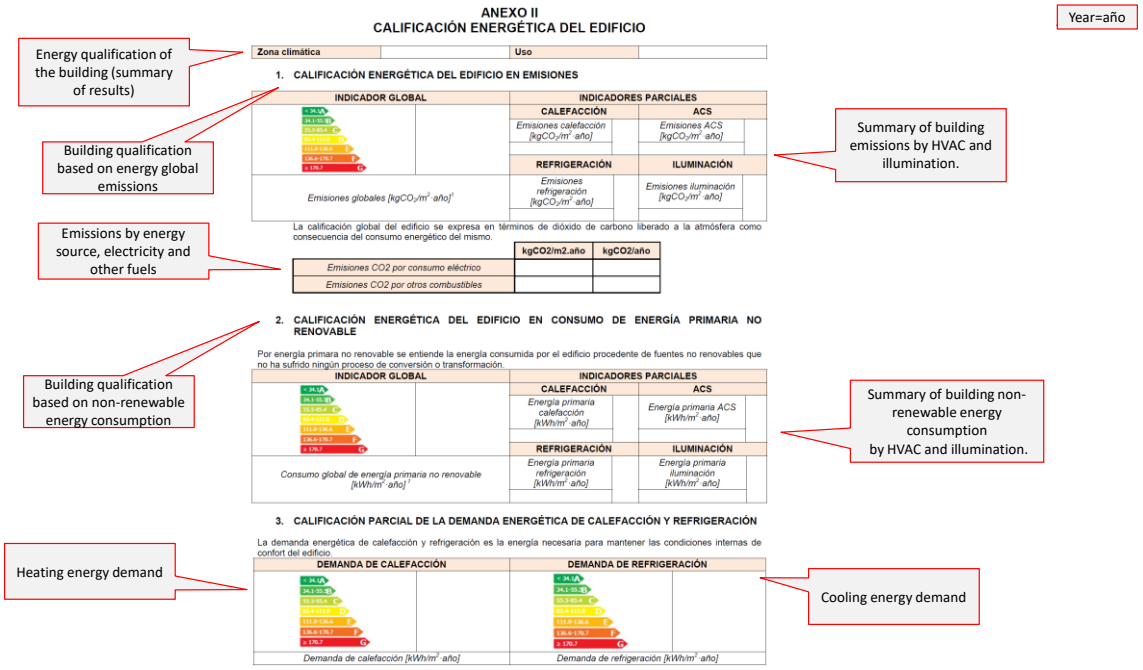
The EPC of a building is the "sum" of all the parts of the analysis, in the annex II the different parts are broken down so the users can know which bits of the building have the major effect on determining the final rating. It is divided in three sections, building emissions (1), non-renewable energy consumption (2) and partial demand for heating and cooling (3).

Sections 1 and 2 are broken down to the different types of demand, HVAC and lighting. Section 3 exposes only de rating for heating and cooling and the energy consumption that awarded that rating (kWh/m^2/year).



Annex III is the list of recommendations to improve the energy rating and is divided among energy consumption and emissions and heating and cooling demand. The table of technical analysis provides a clearer picture of each action, which type of demand affects and how much is expected to improve (energy saved).

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Actions to improve the energy qualification

Actions to improve the energy qualification by area of improvement

Actions to improve the energy qualification technical analysis of savings

ANEXO III
RECOMENDACIONES PARA LA MEJORA DE LA EFICIENCIA ENERGÉTICA

Denominación

CALIFICACIÓN ENERGÉTICA GLOBAL

CONSUMO DE ENERGÍA PRIMARIA NO RENOVABLE [kWh/m2.año]	EMISIONES DE DIÓXIDO DE CARBONO [$kgCO_2/m^2$·año]
< 34.1 A 34.1-55.5 B 55.5-85.4 C 85.4-111.0 D 111.0-136.6 E 136.6-170.7 F ≥ 170.7 G	< 34.1 A 34.1-55.5 B 55.5-85.4 C 85.4-111.0 D 111.0-136.6 E 136.6-170.7 F ≥ 170.7 G

CALIFICACIONES ENERGÉTICAS PARCIALES

DEMANDA DE CALEFACCIÓN [kWh/m^2·año]	DEMANDA DE REFRIGERACIÓN [kWh/m^2·año]
< 34.1 A 34.1-55.5 B 55.5-85.4 C 85.4-111.0 D 111.0-136.6 E 136.6-170.7 F ≥ 170.7 G	< 34.1 A 34.1-55.5 B 55.5-85.4 C 85.4-111.0 D 111.0-136.6 E 136.6-170.7 F ≥ 170.7 G

ANÁLISIS TÉCNICO

Indicador	Calefacción		Refrigeración		ACS		Iluminación		Total	
	Valor	ahorro respecto a la situación original	Valor	ahorro respecto a la situación original	Valor	ahorro respecto a la situación original	Valor	ahorro respecto a la situación original	Valor	ahorro respecto a la situación original
Consumo Energía final [kWh/m^2·año]										
Consumo Energía primaria no renovable [kWh/m^2·año]										
Emisiones de CO_2 [$kgCO_2/m^2$·año]										
Demanda [kWh/m^2·año]										

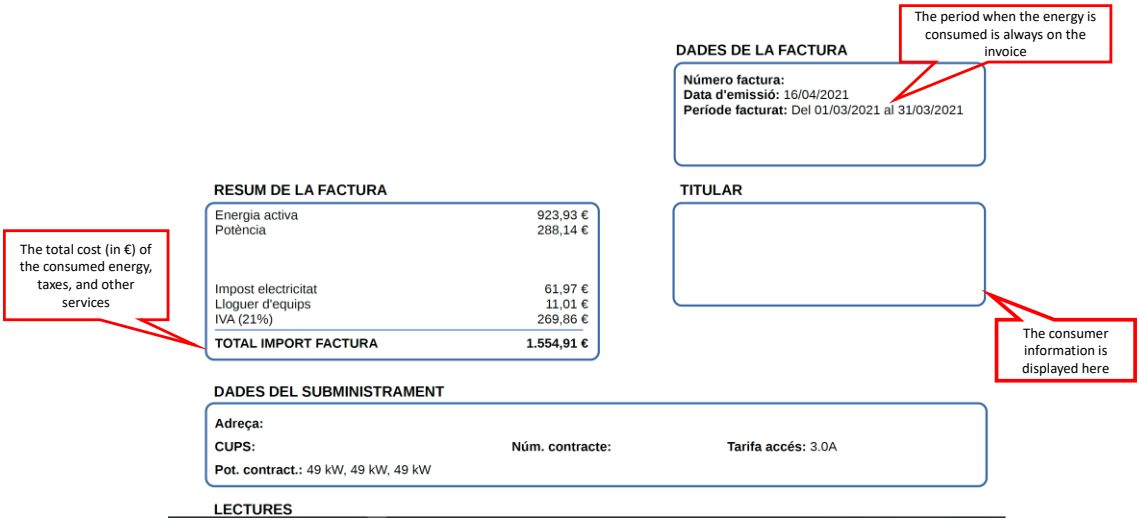
Nota: Los indicadores energéticos anteriores están calculados en base a coeficientes estándar de operación y funcionamiento del edificio, por lo que solo son válidos a efectos de su calificación energética. Para el análisis económico de las medidas de ahorro y eficiencia energética, el técnico certificador deberá utilizar las condiciones reales y datos históricos de consumo del edificio.

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.

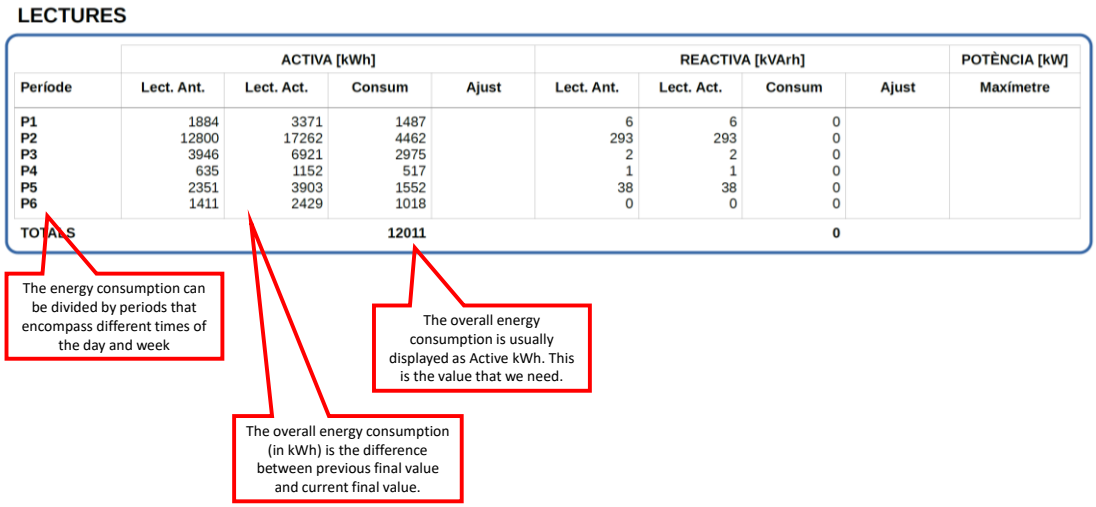
Appendix D: Energy data sources (Spain)

Electricity invoices

The electricity invoice provides the energy consumed in kWh (as the most common metric) for a certain period (usually a month) and the cost of the energy. The invoice also displays the information of the customer (which has been removed from this example).



The consumption that can be found in the electricity invoice is displayed by periods of use. The total number of periods and the hours at which they refer depends on each type of contract. The example below has 6 different periods (they vary during the day and the week).



This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.

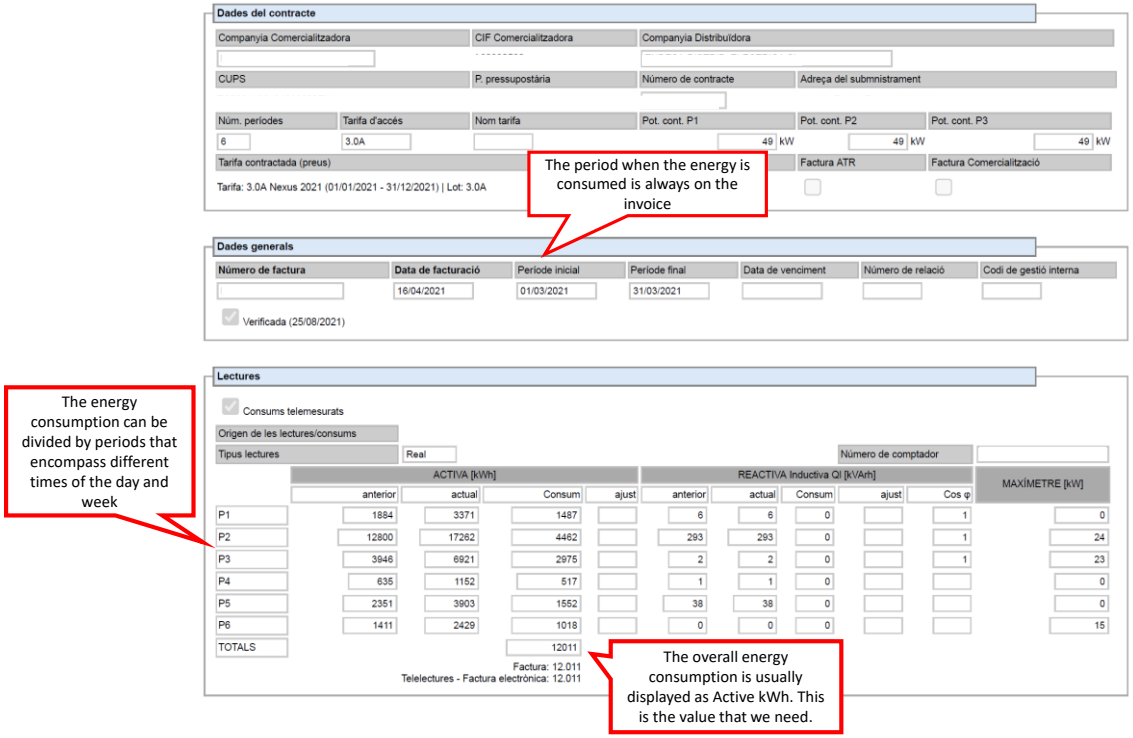
Finally, the electricity invoice describes how the total cost has been calculated:

DETALL DE LA FACTURA

Energia		
Energia activa facturada P1	2.004 kWh x 0,101352 €/kWh	203,11 €
Energia activa facturada P2	6.014 kWh x 0,078455 €/kWh	471,83 €
Energia activa facturada P3	3.993 kWh x 0,062357 €/kWh	248,99 €
Potència		
Potència facturada P1	41,65 kW x 31 dies x 0,111583 €/kW-dia	144,07 €
Potència facturada P2	41,65 kW x 31 dies x 0,066948 €/kW-dia	86,44 €
Potència facturada P3	41,65 kW x 31 dies x 0,044635 €/kW-dia	57,63 €
Impost electricitat	1.212,07 € x 5,11269632 %	61,97 €
Lloguer d'equips		11,01 €
IVA	21 % sobre 1.285,05 €	269,86 €
TOTAL IMPORT FACTURA		**1.554,91 €**

Gemweb platform (accounting platform)

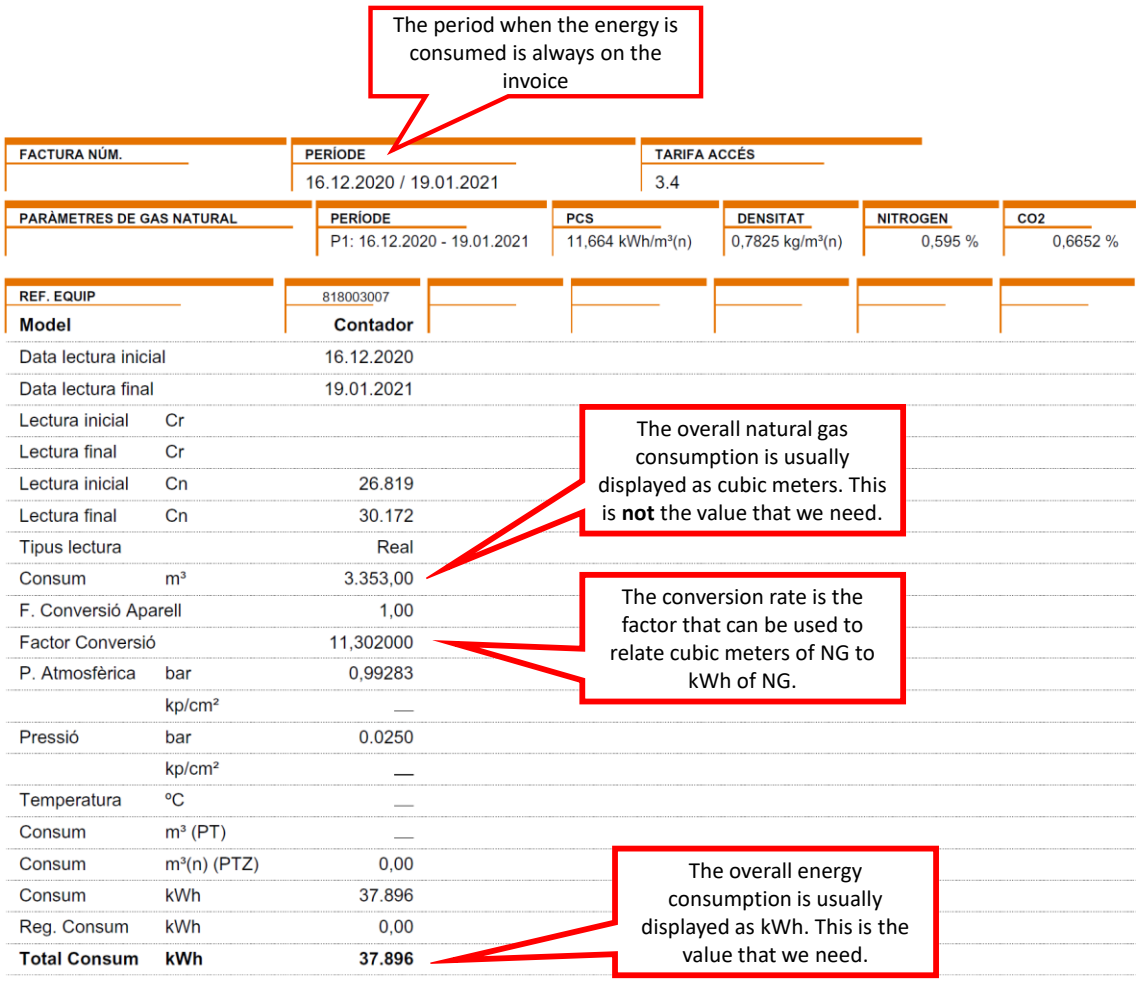
The Electricity invoice can also be consulted on a web service (if it has been hired). The example below is from the Gemweb platform, it does display the same information as any invoice while providing further services (see examples at the end of the Appendix).



This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.

Natural gas invoices

The natural gas invoice also displays the information of the overall consumption, the time-frame of consumption and the client's information. Natural gas is usually measured in cubic meters and then converted to kWh.



FACTURA NÚM.	PERÍODE	TARIFA ACCÉS
	16.12.2020 / 19.01.2021	3.4

PARÀMETRES DE GAS NATURAL	PERÍODE	PCS	DENSITAT	NITROGEN	CO2
	P1: 16.12.2020 - 19.01.2021	11,664 kWh/m³(n)	0,7825 kg/m³(n)	0,595 %	0,6652 %

REF. EQUIP		818003007
Model		**Contador**
Data lectura inicial		16.12.2020
Data lectura final		19.01.2021
Lectura inicial	Cr	
Lectura final	Cr	
Lectura inicial	Cn	26.819
Lectura final	Cn	30.172
Tipus lectura		Real
Consum	m³	3.353,00
F. Conversió Aparell		1,00
Factor Conversió		11,302000
P. Atmosfèrica	bar	0,99283
	kp/cm²	—
Pressió	bar	0.0250
	kp/cm²	—
Temperatura	ºC	—
Consum	m³ (PT)	—
Consum	m³(n) (PTZ)	0,00
Consum	kWh	37.896
Reg. Consum	kWh	0,00
Total Consum	**kWh**	**37.896**

Overall Gemweb example

Gemweb is a web service that provides energy accountability functionalities complemented with energy tracking. The energy accountability has been shown above, and the energy display will be shown below.

The service allows to easily navigate a large portfolio of buildings by using several tabs. The main tab allows to select your building by entity, followed by consumption points and finally energy source to consult (mainly electricity and natural gas).

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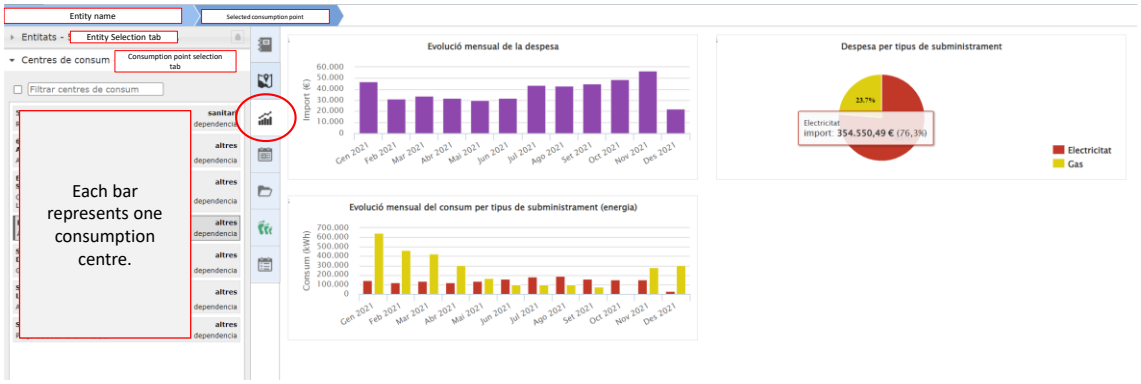
Once a consumption centre has been selected the information regarding its overall energy consumption can be observed and analysed. The specific total consumption by energy source can be selected leading to the information shown above.



Datadis web service

The final example of web service is Datadis. It is a website managed by all energy distributors of Spain that allows any registered user to access the energy consumption of all the assigned consumption points.

Datadis displays any consumption point that is registered to a user and allows to filter them. Once the user has the desired CUPS the information can be accessed online or downloaded. The information can also be accessed using an API which is the selected method applied in EN-TRACK.

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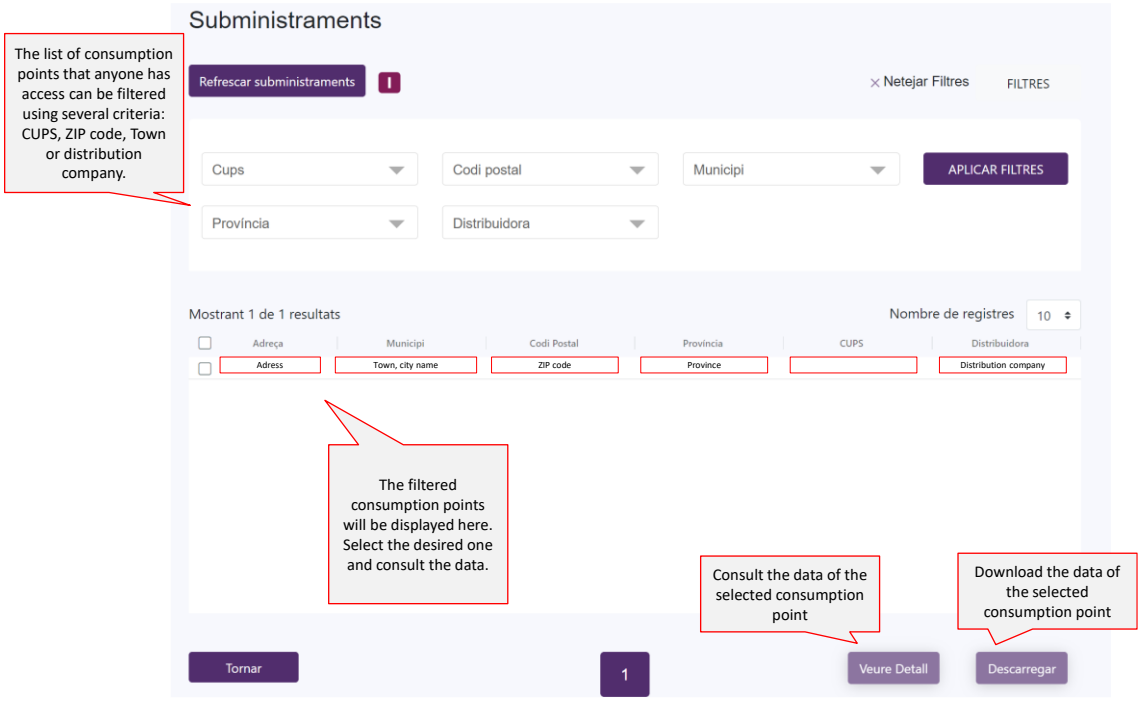
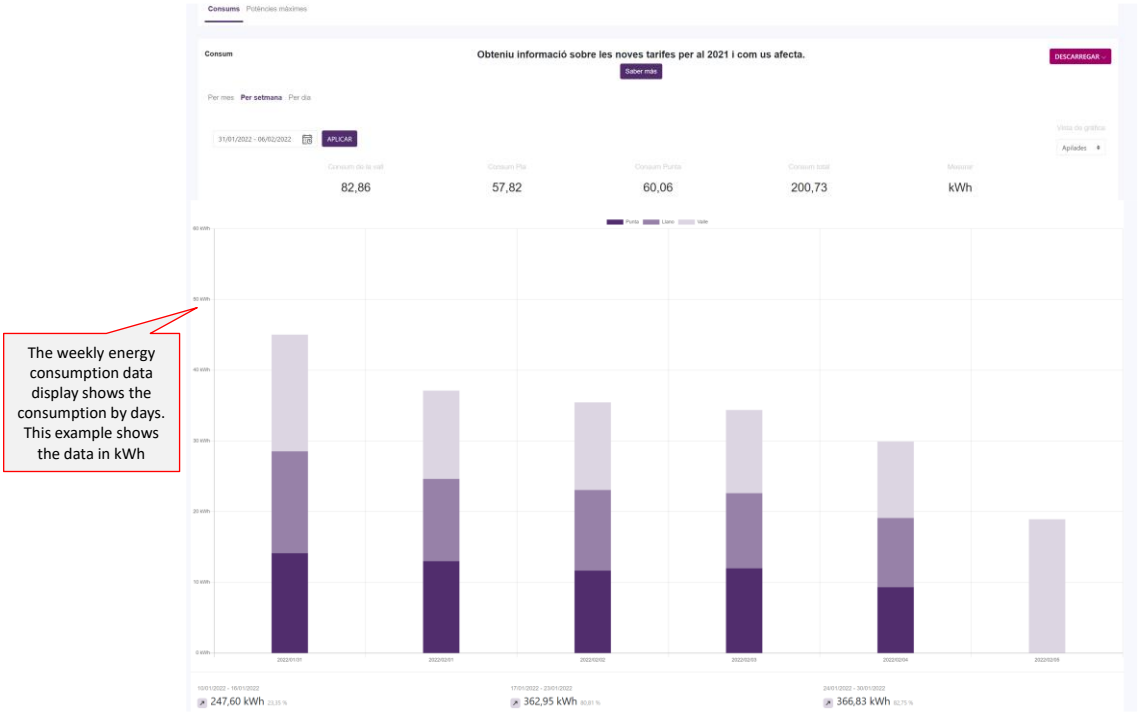


After selecting a CUPS and accessing online the information it can be displayed monthly, weekly or daily. The daily display (shown below) allows to observe the consumption of the day at an hourly rate.

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 885395.

If the energy is displayed at a weekly interval the consumption is shown at daily intervals (see below). Independently of the time scale displayed the same information can be accessed.



The weekly energy consumption data display shows the consumption by days. This example shows the data in kWh

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