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

Training material package for using EN-TRACK by building owners and contractors (interim 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
BOF	Building Owners and Operators Forum
BREEAM	Building Research Establishment Environmental Assessment Method
DEEP	De-Risking Energy Efficiency Platform (DEEP)
EEI	Energy Efficiency Investment
EEM	Energy Efficiency Measure
EPBD	Energy Performance of Buildings Directive
FIF	Financial Institutions Forum
ICP	Investor Confidence Project
LEED	Leadership in Energy and Environmental Design

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1 Executive summary

EN-TRACK, which stands for *Energy Efficiency Performance-Tracking Platform for Benchmarking Savings and Investments in Buildings*, is a critical and timely project that seeks to address a number of key barriers holding back greater investments in building energy efficiency. The core objectives of the project, which is funded through the European Union (EU) Horizon 2020 research and innovation programme under grant agreement number 885395, are to:

- Enable massive gathering of data on the before-and-after performance of energy efficiency measures in buildings.
- Create a continuous data collection process through structured engagement with stakeholders.
- Adopt standard data descriptions that align with current international standards and existing data platforms, notably the De-Risking Energy Efficiency Platform (DEEP).
- Create a self-sustaining solution that continues to be viable after the completion of the project in 2023.

The objective of this report is to create and provide the basis for the training material aimed at building owners and operators (BO) using the EN-TRACK platform. It can act as a direct manual for BO in guiding them through the platform requirements in terms of data to be provided, preparing them for its official launch. The report reviews the available sources of information in both pilot countries (Bulgaria and Spain) aiming to facilitate BO in collecting and verifying the data needed by the platform. This task is a pre-requisite for the platform to work for them, and doing it well is the key to exploit its full potential.

The report also summarises the main benefits for BO, guiding them through the platform functionalities and outputs and describing how they can benefit from them. It highlights how EN-TRACK works for BO, facilitating the building management process by:

- Enabling operational control, monitoring and verification of implemented Energy efficiency measures (EEM).
- Supporting the elaboration of short- and long-term building renovation strategies at local level.
- Attracting funding for building renovation projects.

The report will be further complemented by a second one, expected in December 2022, once the platform is fully operational. It will focus more on the practicalities of the platform and the two documents combined will create a solid basis for the training materials to be produced in various formats, such as videos, platform wiki, and communication materials.

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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 not always in a form convenient for further processing (e.g. paper invoices or scanned documents). This was identified both during the Building Owners and Operators Forum (BOF) in November 2021 on data collection and verification and during other meetings between EN-TRACK experts and BO. Another obstacle (specific to Bulgaria) is 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.

3 Introduction

The purpose of this document is to support building owners and operators (BO) in the process of collecting and verifying data about the buildings they manage, so that they can make the most of the services provided by the EN-TRACK platform. The main chapter of the document covers the follows topics: 1) Benefits for BO; 2) How to benefit from EN-TRACK; 3) Outputs provided by EN-TRACK; and 4) How to use the provided outputs.

The document is supplemented by four appendices with practical examples describing the available data sources and guidance on how the extract the useful information from these sources.

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4 EN-TRACK for building owners and operators

Data availability and management is considered one of the barriers to sustainable building renovation. Without reliable and verified information it is difficult to create confidence in financial institutions about the actual benefits of a project. In most cases, adequate monitoring systems and well-structured data about the energy characteristics and the energy consumption of the buildings are missing. This makes it difficult to accurately assess the financial benefits of already implemented or potential energy efficiency projects without in-depth techno-economic analyses. This section focuses on how EN-TRACK overcomes this barrier and how BO can make the most of the features offered by the EN-TRACK platform.

4.1 Benefits for building owners and operators

The revision of the Energy Performance of Buildings Directive (EPBD), in the last quarter of 2021, aimed at strengthening the obligation to obtain an Energy Performance Certificates (EPC). Transposition of the revised EPBD into national policy and regulatory instruments is expected to facilitate the work of BO in improving the quality of renovation works and improve the monitoring of financial investments. For this to be effective, local authorities need to have the right tools to process and analyse their building stock data. Unfortunately, in most cases, this is not the case: cities lack adequate monitoring systems and capacity. One of the objectives of EN-TRACK aims precisely to resolve this problem, to provide services that will facilitate the building management process by:

- Enabling operational control, monitoring and verification of implemented Energy efficiency measures (EEM).
- Supporting the elaboration of short- and long-term building renovation strategies at local level.
- Attracting funding for building renovation projects (see section 4.4. for more details).

4.2 How to benefit from the platform

To benefit from the services of the platform, users must provide data on their buildings. This input not only provides the basis for the user's own output, is also contributes to the overall power of the platform: the more, good, data provided the more useful the platform becomes for all of its users. To start with, it is sufficient to fill in:

- the location of the building,
- the gross floor area of the building,
- the energy consumption of the building over for at least one year.

This minimum input will allow users to benefit from basic cross-sectional benchmarking and monitoring of the energy consumption.

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The more detailed data users provide to the platform, the more services will be triggered, and the more accurate the benchmarking will become. For example, if a building use type is not identified, it will be compared to all other buildings, but if the building is identified as a hospital, then it will be compared, much more precisely, to other hospitals.

For this reason, it is highly recommended that users fill in as much basic information about their building as possible; information such as year of construction or major renovation, condition of building elements and building systems, details for the implemented EEM, current energy prices, etc. If this information is provided, EN-TRACK is able to provide numerous additional, value-added services, including comparisons of implemented EEMs according to a range of parameters.

Once the basic information is input, the next step is to regularly feed the platform with energy consumption data. This will allow constant monitoring, with alarms generated to users in case of deviations from the expected consumption. In addition, the actual effects of implementing energy saving measures will be monitored, helping users to prescribe corrective actions in case the expected savings are not achieved.

The data needed is usually available but, in most cases, it is not systematically stored in one place and is not easily understood by non-technical staff. Therefore, in the following subchapters we will review potential sources of information for the first two pilot countries (Bulgaria and Spain). The platform is being set up to be suitably well oriented to these two national data use cases. At this stage, as a first approximation, it is being assumed that one or the other of these two cases or a combination of them, will be applicable to other EU Member States so that instructions will have a degree of EU wide relevance and applicability.

4.2.1 Sources of information (Bulgaria)

Detailed information about building energy characteristics is available in the energy audit reports, mandatory for all building with gross floor area over 250 m^2. It is difficult for municipalities in Bulgaria to have up-to-date energy audits for their entire building stock, due to lack of financial resources. Despite this limitation, this information is in fact available for more than 50% of the municipal building stock. These reports include at least the following information: building typology and end use; characteristics of the building envelope (area and U-values), technical specifications of the building systems, monthly energy consumption for a three year period; type of the construction; user behaviour; indoor environmental quality; recommended energy efficiency measures including technical and financial analyses.

The reports from the energy audits are accompanied by a standardised summary in MS Excel and an Energy Performance Certificate (EPC) for the building. The data in the summary is easy to process and can be automatically uploaded to the EN-TRACK platform. It also includes energy balance of the building, the actual and climate normalised energy consumption as well the expected consumption after implementation of recommended energy efficiency measures (EEM). Examples are presented in Appendix A.

Although information about the energy consumption is presented in the energy audit, it only covers the period before the audit. At this stage, systematic information on the consumption of

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the building stock is not available and has to be manually extracted from the invoices and their annexes. In the most common case, municipal experts rely on the accountants of individual sites to provide data on energy and fuel consumption. However, accountants are not always aware of the content of the invoice and often provide inaccurate data. Specific examples of actual invoices from different suppliers are therefore presented in Appendix B with explanations of what information should be reported for energy monitoring purposes. Also, if advice is needed on how to read individual invoices, municipal experts or accountants can contact the EN-TRACK team for help via the Help Desk section of the project website (https://en-track.eu/building-owners-and-operators/).

4.2.2 Sources of information (Spain)

Detailed information about the building's energy characteristics is available in the EPCs, which are mandatory for any building that aims to be sold, rented or is owned by a public administration and has a gross floor area over 250 m^2.[1] The rate of production of building energy audits is lower than that of EPCs. For this reason, ICAEN has recently developed a software complement and a method to perform a basic energy audit along with the EPC (requiring use of the CE3X software). The EPC report includes information about building typology; characteristics of the building envelope (area, solar gains and U-values); technical specifications of the building systems; energy sources (including renewables energies within the building); and recommended energy efficiency measures (with a focus on the technical analysis). Examples are presented in Appendix C. The EPC reports are saved in *.xml files that contain all the information of the EPC and are saved as open data, which facilitates their incorporation to EN-TRACK.

Other sources of information for the building characteristics are the official cadastre (property register) and the Catalan government building database (also known as GPG). The official cadastre contains basic that holds information of all building such as surface and location; and the GPG which stores general building information of the Catalan government, location, surface, etc.

The energy consumption data of the buildings can be obtained from different sources. The traditional source of information are the energy invoices, usually managed by the financial/accounting department, see comments in section 4.2.1. These contain the overall energy consumed (divided by periods of consumption which depend on each tariff) and the total cost of the energy consumed (including taxes and other items). The energy invoice is usually for electricity or natural gas. In order to access the invoices, there are platforms that provide accountability services (examples in Appendix D), they store all the invoices of a building or group of buildings, extracting the energy cost and total consumption. They are flexible enough to include natural gas consumption along with electricity from different providers.

[1] Based on "Real Decreto 390/2021", of 1st of June 2021. https://www.boe.es/boe/dias/2021/06/02/pdfs/BOE-A-2021-9176.pdf#_blank

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The second source of energy consumption (for electricity) is to directly access the energy consumption data from smart meters. The Datadis platform[2] (or any other energy distributor platform) allows access to building electricity consumption, storing up to two years of information (examples in Appendix D). One of the main advantages of this platform is that it has two years of energy consumption at an hourly data level, which will be great for the EN-TRACK platform to provide advanced functionalities with a high degree of confidence. Another advantage is the capability of using an Application Programming Interfaces (API) to obtain the information of any building, easing the process of uploading the data and reducing the change of lost data or misread information.

4.3 What does EN-TRACK provide as output

Aggregating and providing data on building energy performance and energy consumption requires additional efforts from BO. However, by entering this data into the EN-TRACK platform, BO will receive the following services:

- Benchmark and compare the performance of buildings before and after projects/EEMs.
- Benchmark and compare the financial performance of EEMs.
- Track the impact of subsidies and incentives on building energy performance or EEM implementation, and track projects certified by Investment Confidence Project (ICP) or other rating systems.

For providing these services the platform will use four different tracking methods that are all described below. The methods track the energy performance of buildings, EEMs, and investments that will help building owners to assess performance; reveal the potential of renovation projects; and stimulate the gathering of data for promoting energy efficiency investments[3]. Based on these methods, the platform reports and benchmarks a number of indicators of the financial and energy performance of buildings and EEMs.

4.3.1 Tracking methods

Simple tracking

Definition: Simple tracking plots some relevant performance indicator over the time. By tracking monthly or annual energy consumption of a building, changes in energy use over time can be quantified to identify increases and decreases in consumption and/or expenditures. Simple tracking relies on energy use totals and does not include normalisation.

[2] Datadis platform english version: https://www.datadis.es/en/

[3] Energy Information Handbook: Applications for Energy-Efficient Building Operations. Lawrence Berkeley National Laboratory, LBNL-5272E, 2011. Authors: Granderson, J, Piette, MA, Rosenblum, B, Hu, L, et al.

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Purpose: Simple tracking is the most basic forms of energy consumption accounting. Energy use from one period to another is inspected for increases, decreases, or long-term upward or downward trends. Simple tracking is the starting point for the other analysis methods and is the first step in measurement-based approaches to energy management. It can be applied to energy end use, utility costs or emissions tracking.

Longitudinal benchmarking

Definition: Comparison of the building's performance to itself over time. The longitudinal benchmarking compares the energy use in a fixed period for a building, system, or component to a baseline period of the same length and ideally corrects by factors such as climate.

Purpose: By comparing the current building or system performance to that of previous years allows to determine if performance has deteriorated or improved, to identify opportunities for improvement, to set goals, or to detect unexpectedly high usage. The longitudinal benchmarking can be applied to time series variables such as energy use, cost, emissions, as well as to various of the indicators defined below, in order to visualise the changes in performance over time.

Cross-sectional benchmarking

Definition: Comparison of the building's performance with a group of similar buildings. The cross-sectional benchmarking may compare a building's energy use to a "standard" energy use of a group of buildings, where "standard" could be defined in several ways, the simplest being the mean or average of the energy use of similar buildings. The standard use of the peer group then serves as the benchmark against which the building performance is compared. Alternatively, the comparison could be done against the distribution of the energy use of a group of similar buildings, indicating its position respect to them.

Purpose: The cross-sectional benchmarking is the first step to determine if a building has the potential to improve its efficiency. It is usually done at the whole-building level, to assess a building's overall energy efficiency, using metrics such as EUI. It might include additional normalisation for climate, occupancy, etc. Cross-sectional benchmarking can be applied to all the indicators defined below.

Cross-sectional benchmarking with time dimension

Definition: Comparison of a building's or EEM's performance indicator with similar ones from a peer group of buildings, considering the time the indicators refer to.

Purpose: Indicators such as the Energy Use Saving Intensity (EUSI) or the Energy Cost Saving Intensity (ECSI) of an EEM, or the Energy Use Intensity (EUI) of a building might have a trend varying in time due to the gradual change of the baseline building technologies over which the EEM is applied (overall characteristics of the building stock), changes of the energy costs or the energy use in the building. As EN-TRACK aims to collect data from different sources that might refer to different moments in time (e.g. year 2010, 2014, 2021) and the full information/context for calculation of the benchmarked indicator might not be available, it is important the user to be able to consider the time dimension in the comparisons.

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4.3.2 Indicators for benchmarking

Energy Use Saving Intensity (EUSI)

When the user benchmarks buildings in EN-TRACK, one of the key indicators highlighted is the energy use saving intensity (EUSI). The EUSI helps compare the energy saving performance of energy efficiency measures in different buildings. A low EUSI generally represents a building which already has good energy performance, or lower potentials for saving energy through EEMs. In contrast, building typologies with higher energy use intensities tend to portray higher EUSI. For example, hospitals tend to use significantly more energy than schools.

Energy Cost Saving Intensity (ECSI)

This indicator is used for comparing the performance of the savings generated by the EEMs in different buildings. This is highly relevant if, for example, the user is looking into structuring an energy performance contract or similar financing method for a project and wants to compare how the potential projects could compare to other existing projects and buildings around the EU.

Emissions Saving Intensity (ESI)

The ESI indicator tells the user how the EEMs are performing in terms of CO_2 reductions. For local authorities who are heavily involved in supporting the achievements of the national goals in terms of energy efficiency and emission reduction, this is a highly relevant indicator as the targets of CO_2 reductions highly influence the decision making when it comes to investments.

Normalised Investment Cost (NIC)

NIC tells the user the unit costs of the EEM (cost/m^2). The user can utilise this indicator to understand the true earnings per EEM and that have the most accurate assessment of how an EEM will affect the building regardless of its size.

Avoidance Cost (AC)

AC is suitable for comparing the value of energy savings (avoided energy costs) to the cost of purchased energy. AC is also useful for comparing with other methodologies for reducing carbon intensity and/or energy costs, such as purchasing Green Certificates, buying offsets, switching fuels etc. 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.

Simple Payback (SP)

The payback period is the time it takes to recover the cost of an investment or the time an investor needs to reach breakeven. This indicator is commonly used by financial institutions and fund managers to determine if an investment is worthwhile.

The payback period is favoured when the user has short-term cash flows as a concern, a short payback period can then be more attractive than a long-term investment even if said long-term investment has a higher NPV.

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Net Present Value (NPV)

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.

Profitability Index (PI)

The PI is an appraisal technique commonly applied in project finance. PI is calculated by dividing present value of future expected cash flows by the initial investment amount in the project. It is helpful to FIs because it effectively allows different projects to be ranked in terms of value per investment unit. 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.

Net Present Value Quotient (NPVq)

NPVq is the ratio between the NPV and the investment made. It shows what discounted amount is generated against a unit of investment. NPVq allows the revenue that will be obtained from an investment to be estimated. Its main function is to rank multiple EEMs and/or potential projects. This allows investors to estimate what revenue to expect by multiplying the NPVq by investment, if they implement the measure(s) and/or project(s) in several other buildings, which is often necessary in municipal energy planning.

Internal Rate of Return (IRR)

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 would probably be considered the best.

4.4 How to use this output

As mentioned in section 4.1. the BO can use the above services and indicators to perform a wide range of analyses and decision support operations. These include:

Enabling operational control, monitoring and verification of implemented EEMs.

Systematic recording and analysis of energy consumption data presents an opportunity to optimise energy and fuel supply contracts and planning, implementation and monitoring the impact of energy saving measures. It also enables user awareness raising and development of energy certificates and energy reports. In addition, the platform will facilitate efficient energy

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management, which is the basis for implementing so-called low-investment measures. Experience shows that these are the measures with the best cost-benefit ratio[4]:

- Improved energy control: Savings potential > 5%, cost-benefit ratio: 1:5 to 1:10
- Energy optimisation: Savings potential > 15%, cost-benefit ratio: 1:5 to 1:10
- Investment measures: Savings potential > 15%, cost-benefit ratio: 1:5 to 1:10

Supporting the elaboration of short- and long-term building renovation strategies at local level.

Building renovation strategies at local level should be developed on the basis of detailed information about the current state and the prospects for development of the energy sector in the municipalities and the individual sites related to it. Collecting this information is necessary, however not sufficient for the development of a renovation strategy, as it does not contain data about the energy efficiency potential and does not rank the possible energy efficiency projects.

EN-TRACK not only provides space to collecting the needed information at one place, but also automatically process this information, generates useful reports, and provides benchmarking, which greatly facilitates the planning process.

Attracting funding for building renovation projects.

The creation of a large database of implemented and planned energy efficiency projects, an assessment of the actual energy and financial benefits achieved by these projects, and a large set of benchmarking analyses based on various key techno-economic indicators, is intended to create confidence among financiers in the credibility and economic viability of these projects. The task of compiling this database and creating this confidence is shared between the EN-TRACK project team, through the development of this platform, and the BO by inputting the necessary information. Furthermore, the platform will be widely communicated with numerous financial institutions. By providing them with specially designed services, we expect to enable and encourage them to look at energy efficiency projects in a new light and, consequently to identify business opportunities and, ultimately initiate contacts with building owners on their own initiative in the search for future fruitful collaborations.

[4] Finus, O: Das (Durch)StarterPaket, StarterMaßnahmen für das Handlungsfeld 1: Energieeinsparung, kommunales Energiemanagement [Coaching Municipal Climate Action: The Starter Package, Starter Measures for Action Field 1: Energy Saving, Municipal Energy Management], 2015. Available online under: https://www.coaching-klimaschutz.de/fileadmin/inhalte/Dokumente/StarterSet/Coaching_DurchStarterPaket_1_Energiemanagement.pdf, last access February 2022.

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5 Further development

The information and guidance in this report will initially be used to create various training materials and also in communication and dissemination. It will also be put to good use in the BOF which is hosted on a quarterly basis and aims to attract BO in using the services provided by the EN-TRACK platform. Future iterations of this training material will include a video and wiki system with options for assistance by a platform partner when needed. Users will be able to report any problems or request assistance via the platform and contact details will be available in case of urgent matters.

Once the platform is fully developed and in active use, this training material will be further developed to include detailed, step by step, guidance for use of the platform. User trials will be used to help develop the platform and identify which parts of the platform require extra guidance material and active support.

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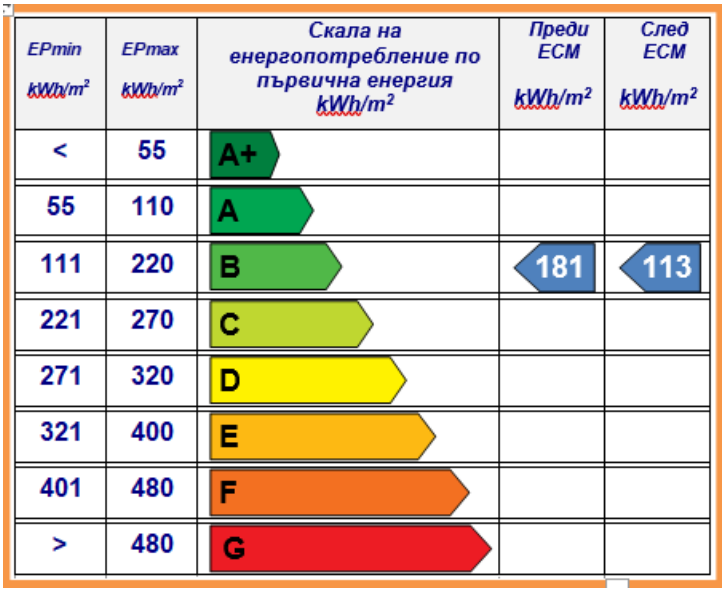
Appendix A: Sources of general building data (Bulgaria)

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		
		Референтен	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	$\eta_{система} \geq 70$ %
			...	...	$\eta_{система} \geq ...$ %

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**

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

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.

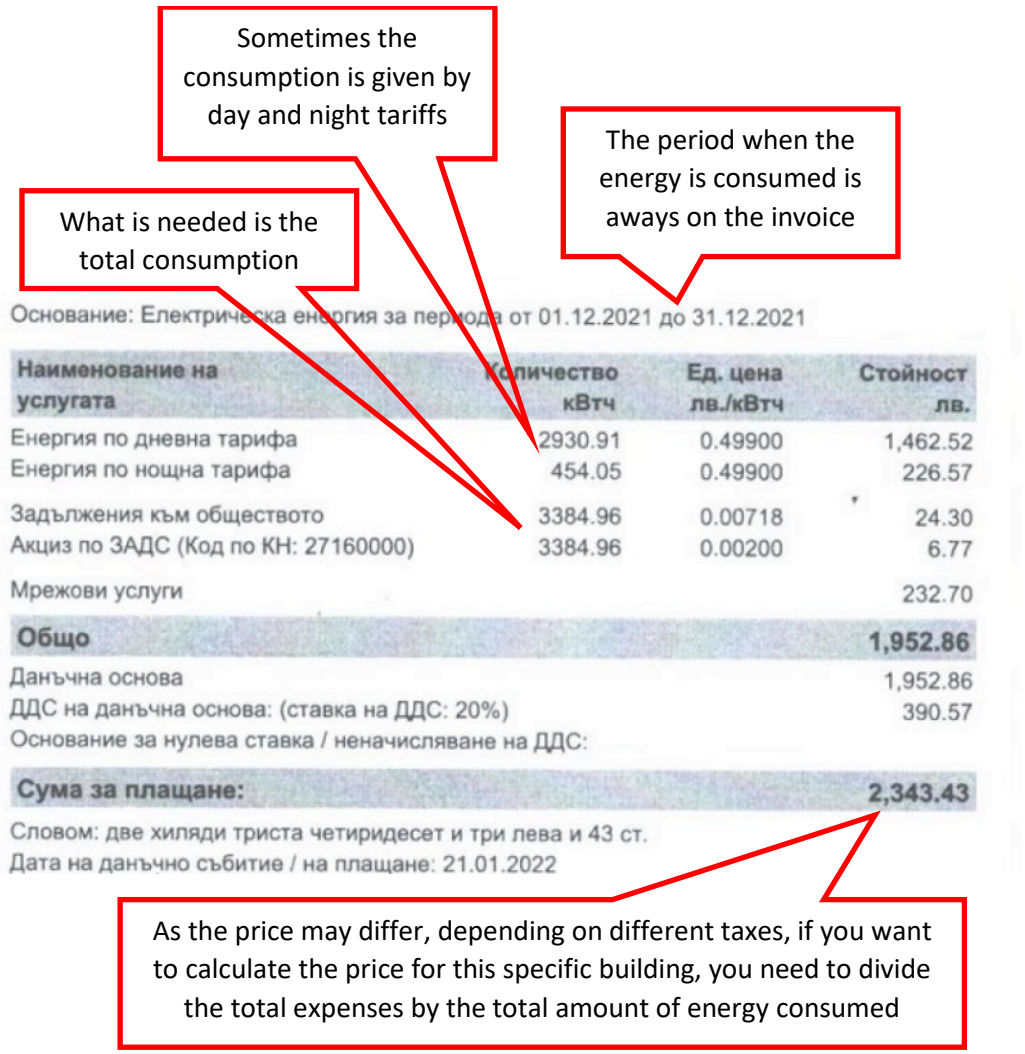
МЕРКИ		ЕНЕРГИЯ		СПЕСТЕНИ ГОРИВА И ЕНЕРГИЯ				НЕОБХОДИМИ ИНВЕСТИЦИИ	СРОК НА ОТКУПУВАНЕ	РЕДУЦИРАНИ ЕМИСИИ CO_2
	П2	№	ЕНЕРГИЕН РЕСУРС	t/год.	Nm^3/год.	kWh/год.	лв./год.	лв.	год.	t/год.
12	**ОБЩО ГОДИШНО СПЕСТЯВАНЕ НА ЕНЕРГИЯ СЛЕД ИЗПЪЛНЕНИЕ НА ВСИЧКИ ECM ОТ ИЗБРАНИЯ ПАКЕТ**	1	МАЗУТ	0	0	0	0	0		0
		2	ДИЗЕЛОВО 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.

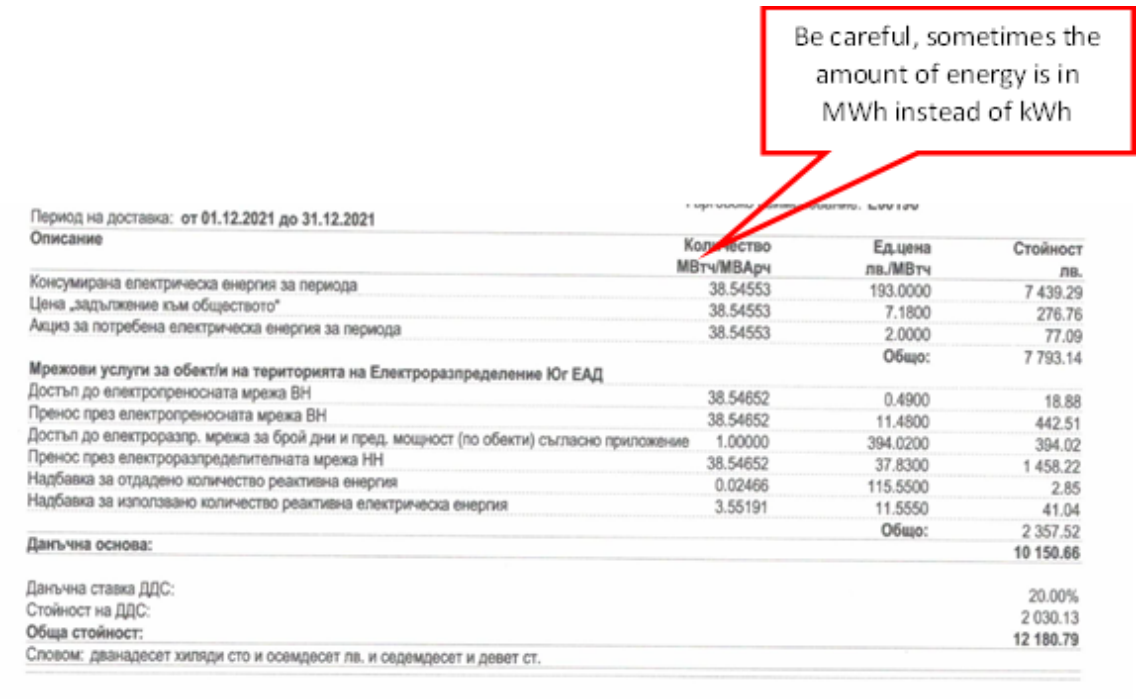
Appendix B: Energy data sources (Bulgaria)

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.



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.			

Sometimes the period is given like this

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

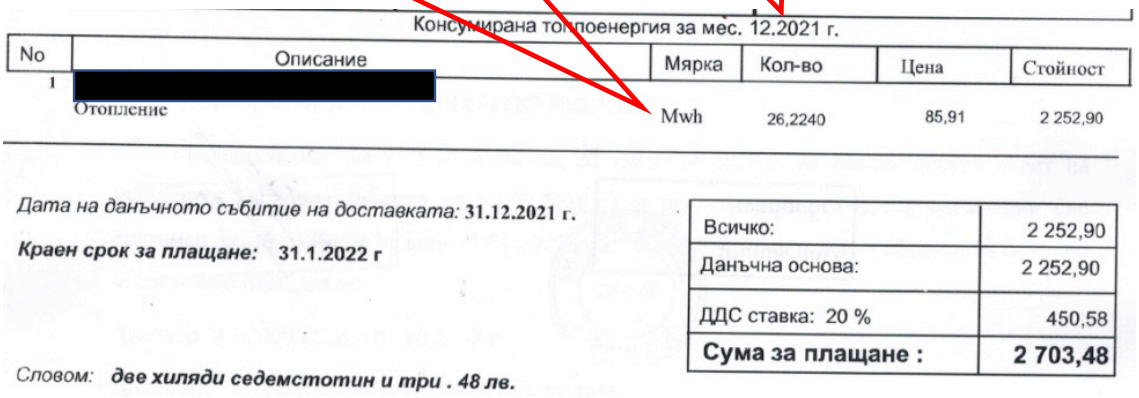
Реална консумация в хиляди куб. метри: 2.491

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

District heating invoices

Usually, information is available on monthly base

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



Консумирана топлоенергия за мес. 12.2021 г.

No	Описание	Мярка	Кол-во	Цена	Стойност
1	[redacted] Отопление	Mwh	26,2240	85,91	2 252,90

Дата на данъчното събитие на доставката: **31.12.2021 г.**

Краен срок за плащане: **31.1.2022 г**

Всичко:	2 252,90
Данъчна основа:	2 252,90
ДДС ставка: 20 %	450,58
Сума за плащане :	**2 703,48**

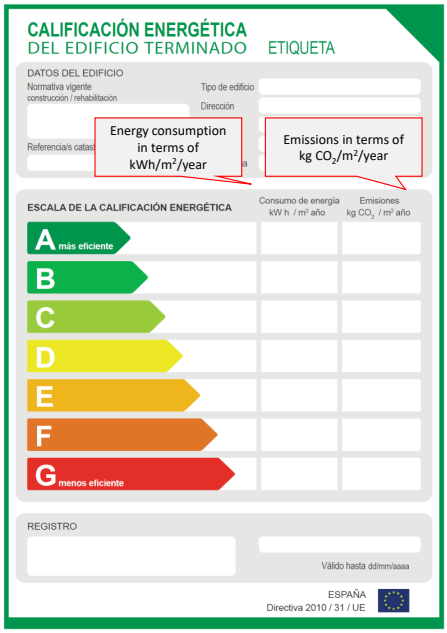
Словом: ***две хиляди седемстотин и три . 48 лв.***

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 buildings have to do a more extensive analysis compared to the domestic ones.

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It does refer to the main characteristics of the building.

The report differentiates between domestic (vivenda) and tertiary buildings. Tertiary buildings have more sections to fill out.

Tipo de edificio o parte del edificio que se certifica:	
☐ Edificio de nueva construcción	☐ Edificio Existente
☐Vivienda ☐Unifamiliar ☐Bloque ☐Bloque completo ☐Vivienda individual	☐Terciario ☐Edificio completo ☐Local

DATOS DEL TÉCNICO CERTIFICADOR:

Nombre y Apellidos		**NIF/NIE**	
Razón social		**NIF**	
Domicilio			
Municipio		**Código Postal**	
Provincia		**Comunidad Autónoma**	
e-mail:		**Teléfono**	
Titulación habilitante según normativa vigente			
Procedimiento reconocido de calificación energética utilizado y versión:			

CALIFICACIÓN ENERGÉTICA OBTENIDA:

Energy consumption in terms of kWh/m²/year

CONSUMO DE ENERGÍA PRIMARIA NO RENOVABLE [kWh/m2.año]	EMISIONES DE DIÓXIDO DE CARBONO [kgCO₂/m²·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

Emissions in terms of kg CO_2/m^2/year

A common set of information for all buildings is the total surface of the building. Another set of common information is the properties for the building envelope which are 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).

This section provides the habitable surface.

This sections provides the data referring to the enveloping bits of the building, for example windows.

This sections provides the data referring to the windows-like openings. In this case the he transmittance values (Transmitancia) are reported along with the surface of each section and solar related factors, like solar factor.

This sections provides the data referring to the enveloping bits of the building that refer to walls, internal walls, floors, etc. The transmittance values (Transmitancia) are reported along with the surface of each section.

This section covers equipment dedicated to heating (calefacción) and cooling (refrigeración) – HVAC.

Both heating and cooling section provide the nominal power of the equipment, the overall efficiency and the type of energy used.

1. SUPERFICIE, IMAGEN Y SITUACIÓN

Superficie habitable [m²]	

Imagen del edificio	Plano de situación
	

2. ENVOLVENTE TÉRMICA

Cerramientos opacos

Nombre	Tipo	Superficie [m²]	Transmitancia [W/m²·K]	Modo de obtención

Huecos y lucernarios

Nombre	Tipo	Superficie [m2]	Transmitancia [W/m2·K]	Factor solar	Modo de obtención. Transmitancia	Modo de obtención. Factor solar

3. INSTALACIONES TÉRMICAS

Generadores de calefacción

Nombre	Tipo	Potencia nominal [kW]	Rendimiento Estacional [%]	Tipo de Energía	Modo de obtención
TOTALES		-			

Generadores de refrigeración

Nombre	Tipo	Potencia nominal [kW]	Rendimiento Estacional [%]	Tipo de Energía	Modo de obtención
TOTALES		-			

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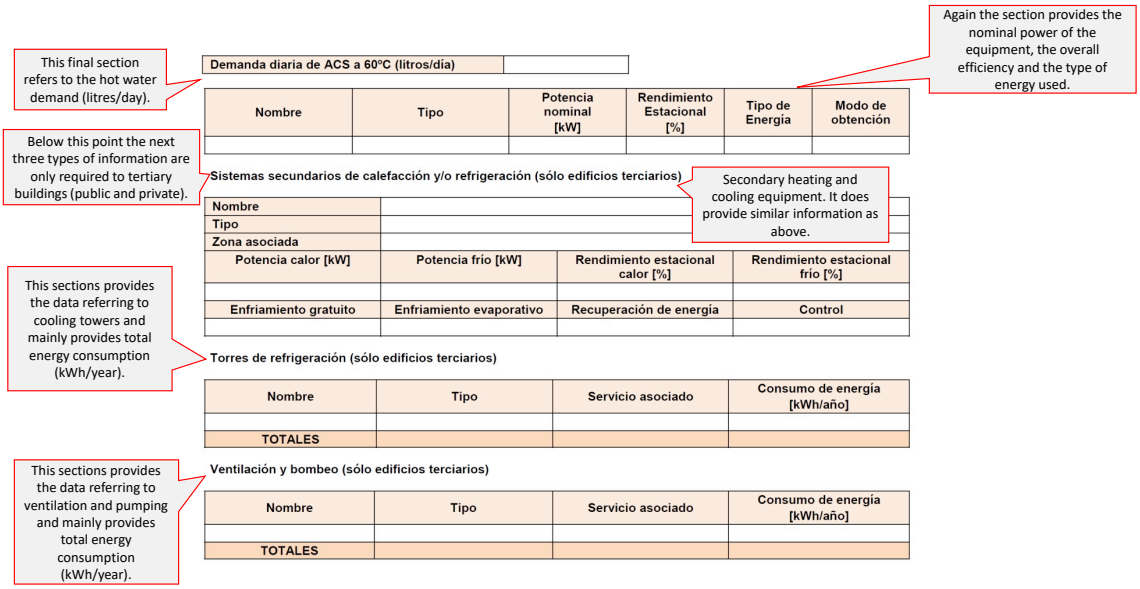
The thermal installations have expanded requirements for tertiary buildings, which include secondary HVAC systems, cooling towers and the ventilation and pumping systems. They provide information about the type of equipment, the energy consumption and the equipment efficiency (only for secondary HVAC)



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 electric energy section measures the amount of energy production using solar panels (assuming there is any).

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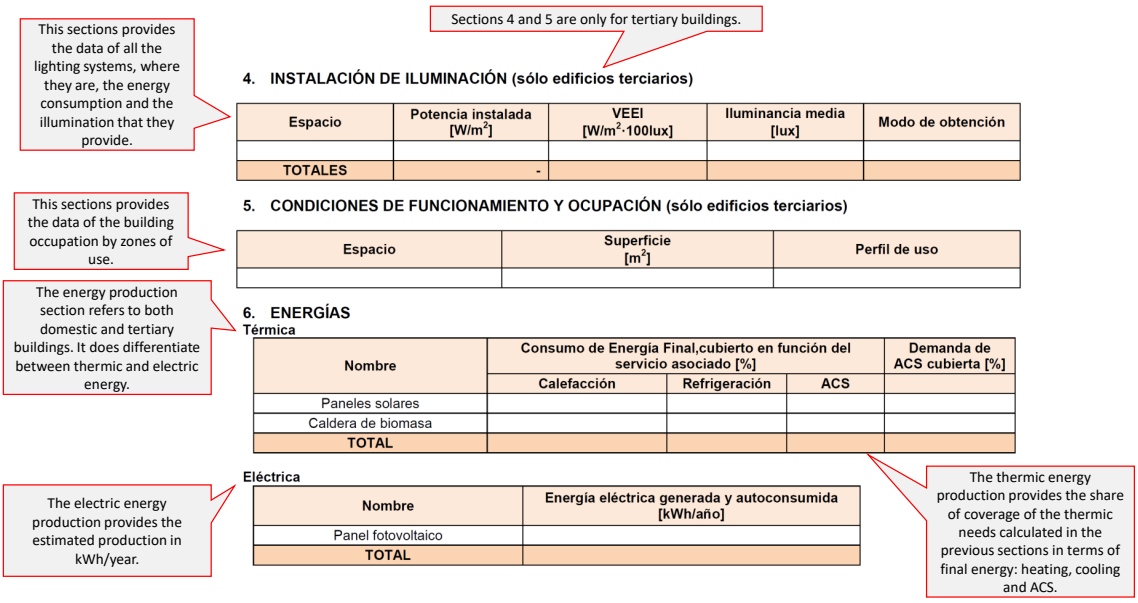
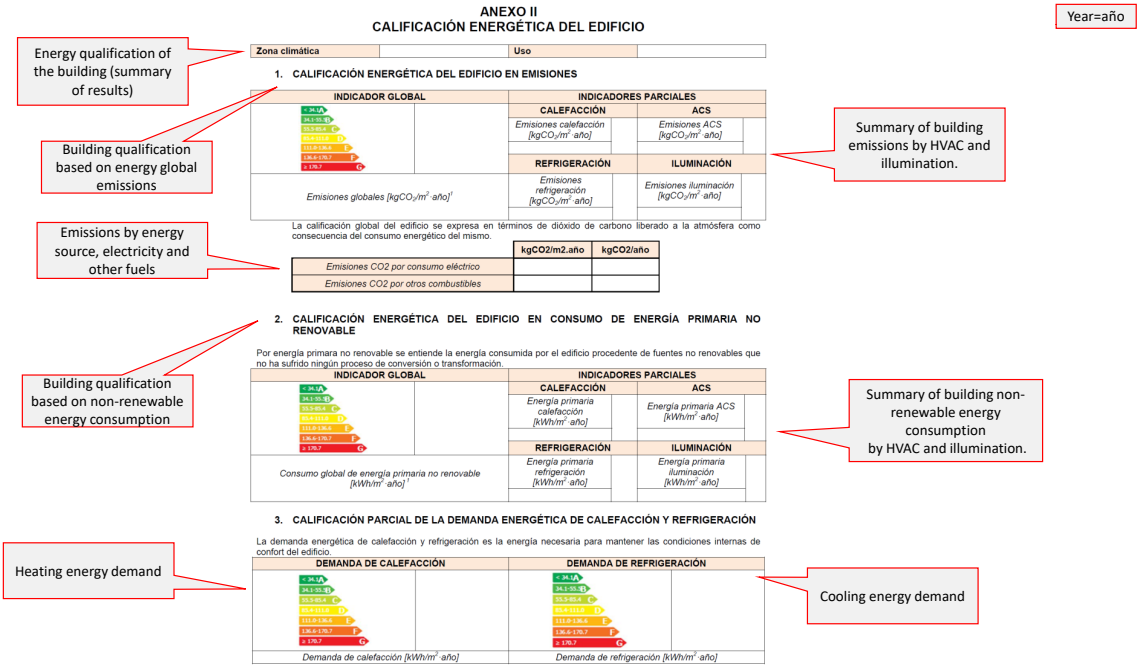


The EPC of a building is the "sum" of all the parts of the analysis, in the annex II the different parts are broken down so the users can know which bits of the building have the major effect on determining the final rating. It is divided in three sections, building emissions (1), non-renewable energy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

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analysis provides a clearer picture of each action, which type of demand affects and how much is expected to improve (energy saved).

Actions to improve the energy qualification

ANEXO III
RECOMENDACIONES PARA LA MEJORA DE LA EFICIENCIA ENERGÉTICA

Denominación

Actions to improve the energy qualification by area of improvement

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

Actions to improve the energy qualification technical analysis of savings

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.

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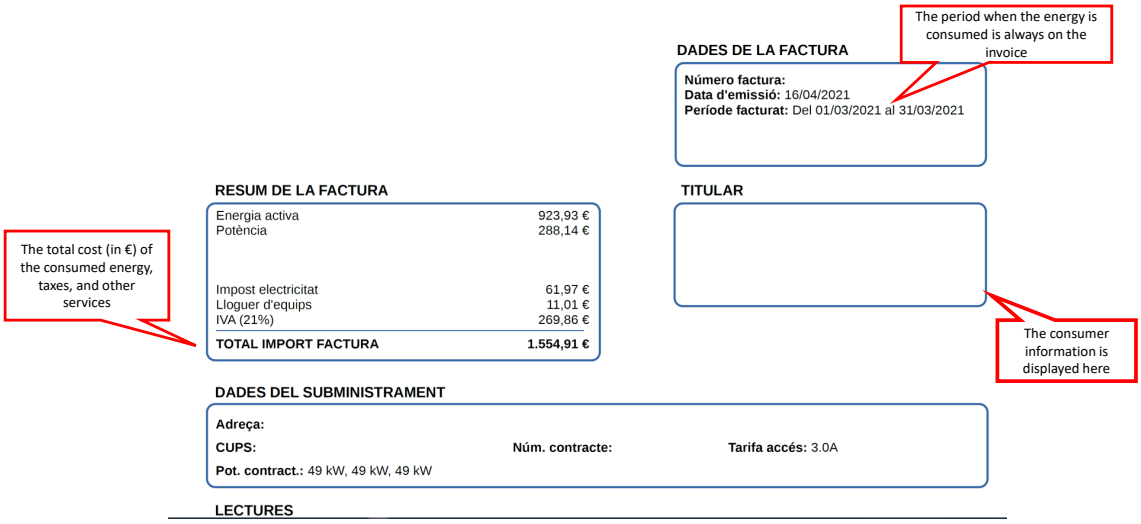
Appendix D: Energy data sources (Spain)

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).

LECTURES

	ACTIVA [kWh]				REACTIVA [kVArh]				POTÈNCIA [kW]
Període	Lect. Ant.	Lect. Act.	Consum	Ajust	Lect. Ant.	Lect. Act.	Consum	Ajust	Maxímetre
P1	1884	3371	1487		6	6	0		
P2	12800	17262	4462		293	293	0		
P3	3946	6921	2975		2	2	0		
P4	635	1152	517		1	1	0		
P5	2351	3903	1552		38	38	0		
P6	1411	2429	1018		0	0	0		
TOTALS			12011				0		

The energy consumption can be divided by periods that encompass different times of the day and week

The overall energy consumption is usually displayed as Active kWh. This is the value that we need.

The overall energy consumption (in kWh) is the difference between previous final value and current final value.

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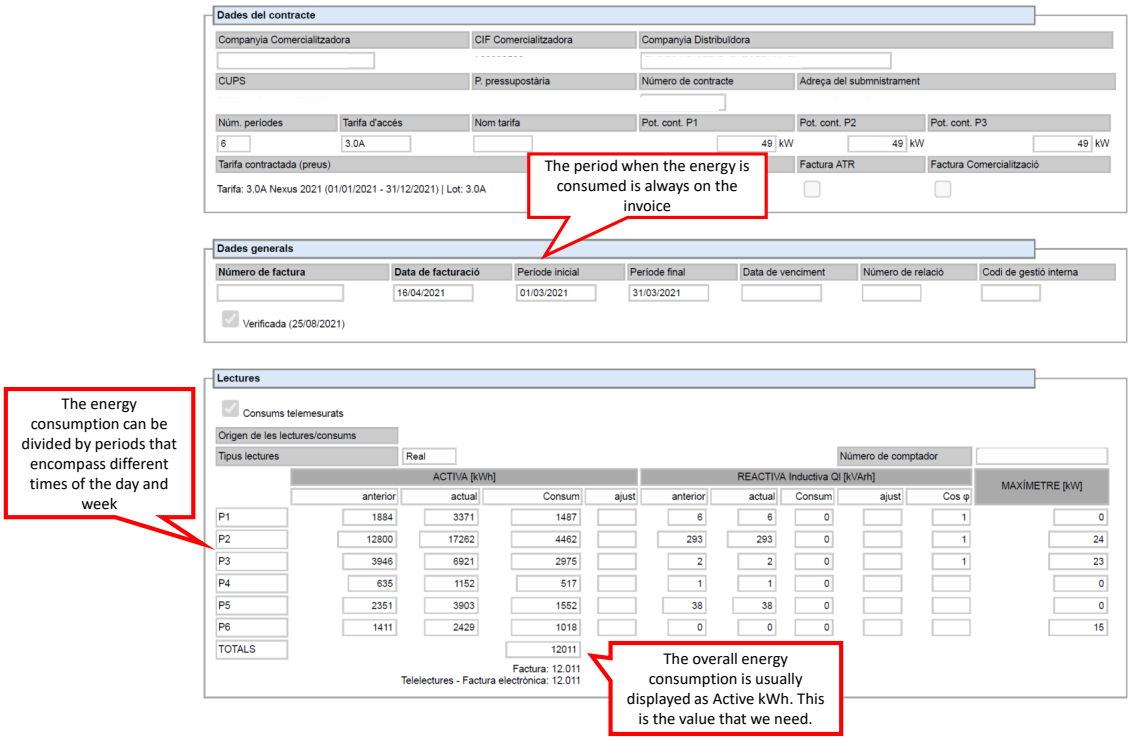
Finally, the electricity invoice describes how the total cost has been calculated:

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).



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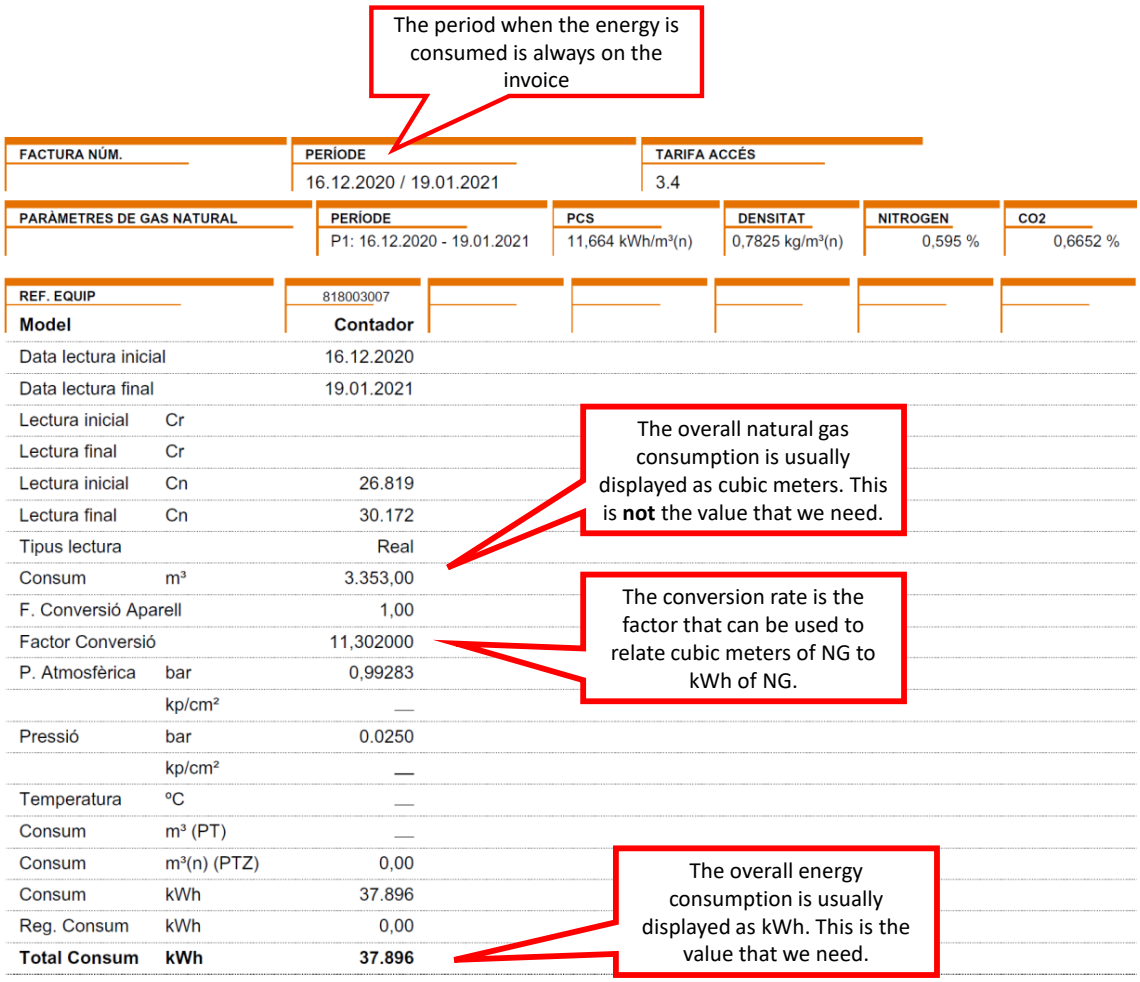
Natural gas invoices

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 counted using cubic meters and then converted to kWh.



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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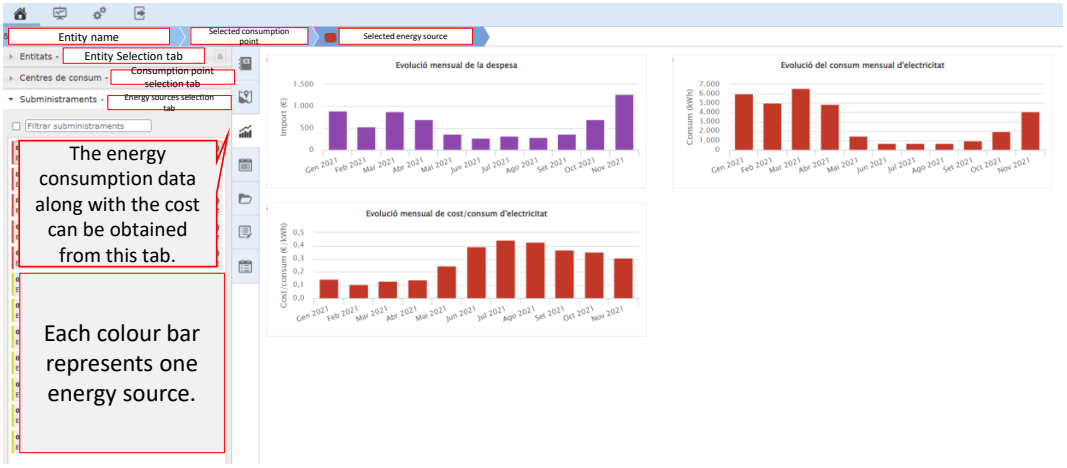
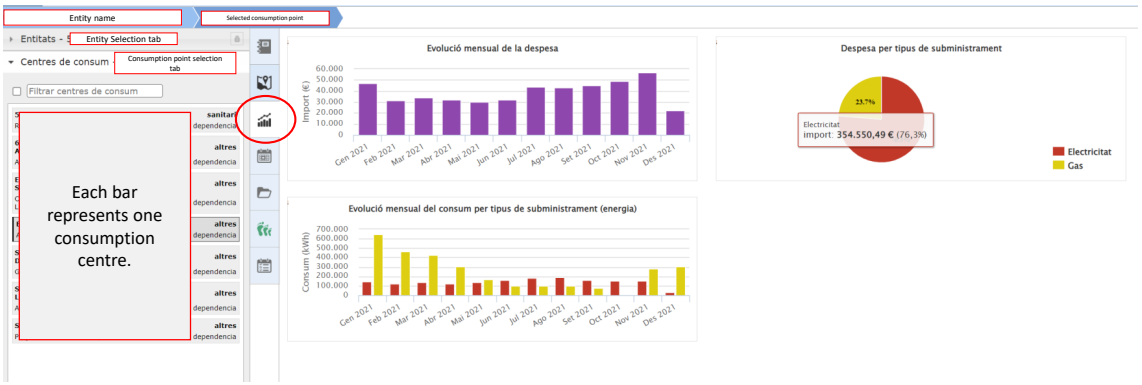


Once a consumption centre has been selected the information regarding its overall energy consumption can be observed and analysed. The specific total consumption by energy source can be selected leading to the information shown above.



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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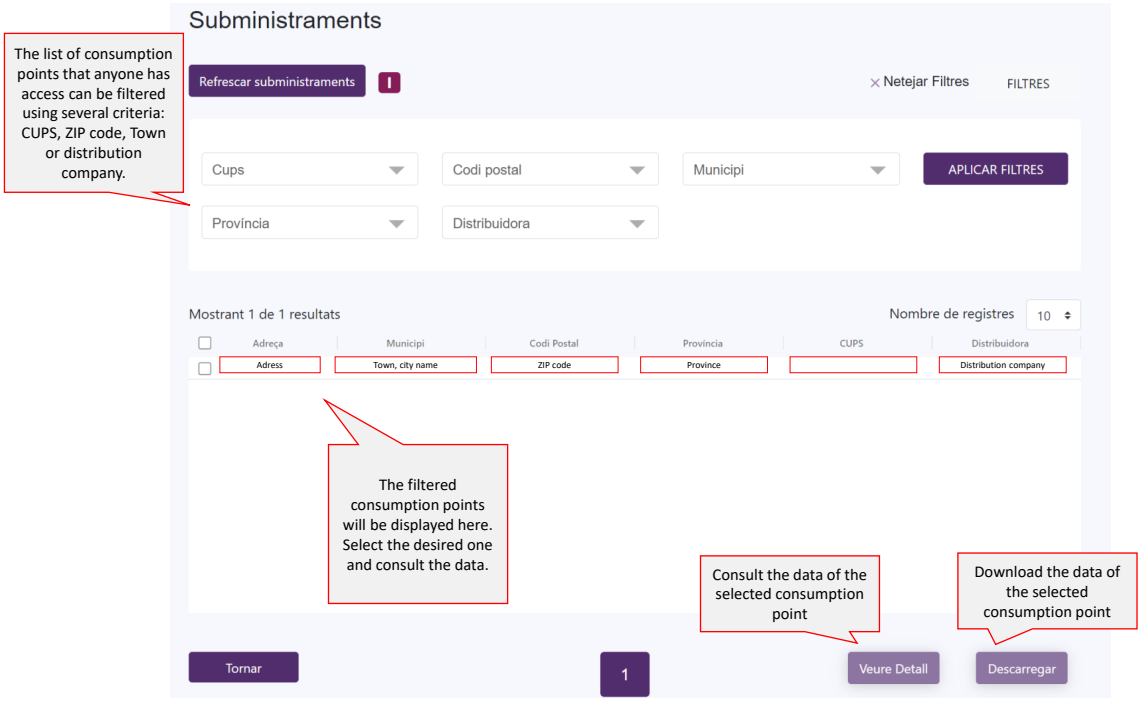

After selecting a CUPS and accessing online the information it can be displayed monthly, weekly or daily. The daily display (shown below) allows to observe the consumption of the day at an hourly rate.

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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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