Web-based demonstrations of the SENSEI model tools (reference guide)

Deliverable 7.2

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 847066.

Smart Energy Services to Improve the Energy Efficiency of the European Building Stock

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Abbreviations and Acronyms

Acronym	Description
API	Application Programming Interface
CA	Consortium Agreement
CSV	Comma Separated Values
DoA	Description of Action (annex I of the Grant Agreement)
DR	Demand Response
EC	European Commission
EE	Energy Efficiency
GA	Grant Agreement
GENCAT	Generalitat de Catalunya
kWh	Kilo Watts per Hour
PC	Project Coordinator
PMC	Project Management Committee
PO	Project Officer
PS	Project Secretariat
QM	Quality Management
SC	Scientific Coordinator
SRI	Smart Readiness Indicator
TMT	Technical Management Team
TL	Task Leader
ToC	Table of Contents
UNICAL	Universita della Calabria
WP	Work Package
WPL	Work Package Leader

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Executive summary

This document is a reference to navigate through the web tools developed within the project, particularly the SENSEI platform and its smart services. The information is aimed at final, non-technical users while conveying the actions needed to graphically interact both with the tools and the data. That is, a guide through platform usage and capabilities via examples. A more technical version of these items is provided in deliverable 7.4, *Functional design options for the SENSEI Platform and smart services*, a deeper source of the context and implementations shown here.

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1 Introduction

The SENSEI web platform is aimed to navigate the project data extracted from several sources such as APIs, CSV files or static sources, independently of their field of expertise. It can help manage the extraction process and visualize the data once extracted.

2 The SENSEI platform

The SENSEI platform acts as a single point of entry to the aforementioned information, gathering and sharing it in a secure way. To this effect, it bases access grant on a series of users and roles, which will lead to different menu options depending on their privilege level. Complementary information can be found in D7.4, *Functional design options for the SENSEI Platform and smart services,* at the project website.

3 Usage

The procedure explained below is a walkthrough of the tools from a final user perspective. To this effect, a generic user is provided with its own roles. Contextual help is available at the top-right corner of the platform, to aid with the context of each screen.

General procedures are described to four main sub-tools: a) the building savings potential estimator, b) the building data monitoring, c) the grid friendliness indicator and d) the SRI calculator.

The building savings potential estimator consists of a dashboard wherein calculations performed about building savings within the project are shown. Building data monitoring is a dynamic dashboard which uses data extracted from Consortium assets via API, by using a specifically developed service. The grid friendliness indicator graphically shows information on calculations and coefficients applied to dynamically loaded CSV data. Finally, the SRI tool links to an external asset in developed by UNICAL as part of T5.4

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3.1 Procedures

3.1.1 Log in

User has to log in at the URL https://demo.senseih2020.eu/login?site=sensei with the provided credentials. These credentials can be requested through through the following email: info@advanticsys.com

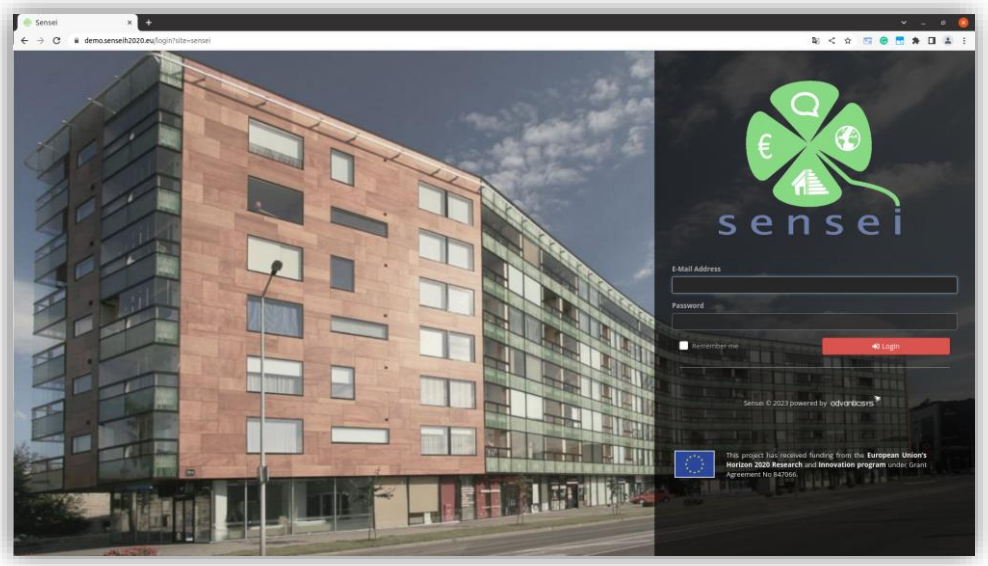

Figure 1: Log in platform page

This will lead to the home page in which the links to the tools are shown in the main panel, while a left menu displays all the options available for the logged type of user.

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Figure 2: Home page, links to tools and menu

3.2 SENSEI Tools

3.2.1 Building savings potential estimator

This dashboard tool supplies visualization over the building-related information of a selection the buildings analyzed within the project. It presents three different styles of visualization: A map, two tables and several charts, which can be radar or bar typed.

Building information included is related to GENCAT assets, featuring energy consumption data, surface and position.

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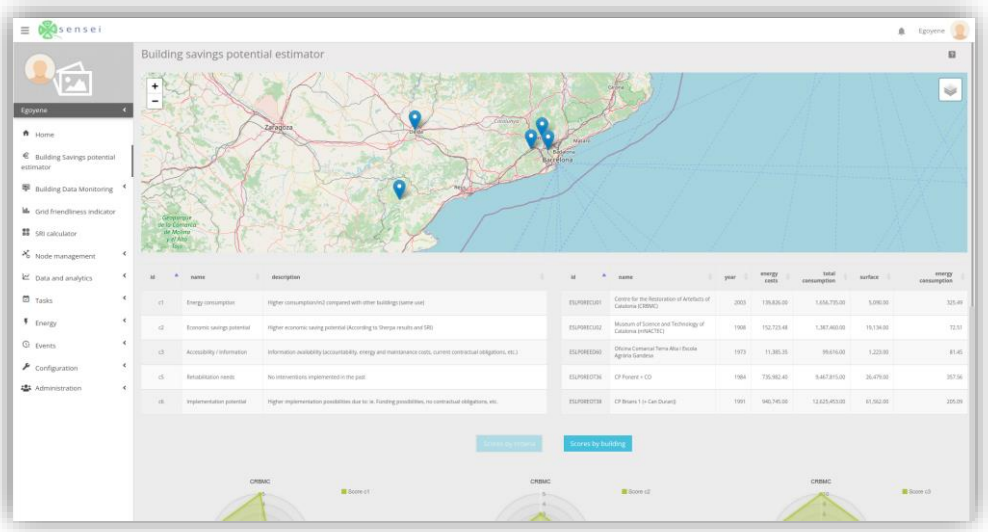

Figure 3: The building savings potential interface

3.2.2 Map

The map shows the geographic location of the described buildings. Moving the mouse over the markers will a) open a pop-up with the name of the selected building and b) highlight in blue, at the building's table, the data associated with that building. The table and the map are reciprocally related: hovering over a building in the table will highlight the marker of the matching marker.

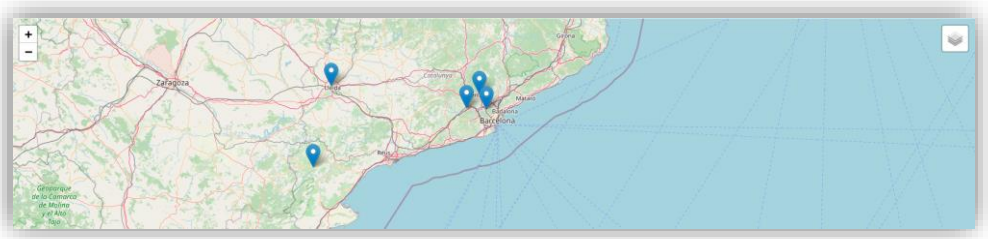

Figure 4: Map visualization

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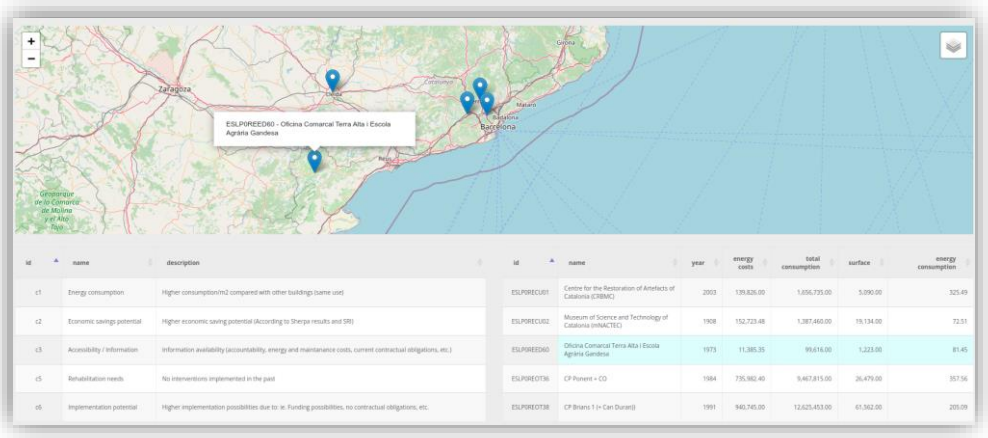

Figure 5: Map-table interrelation

3.2.3 Table "criteria"

It displays information about the criteria used to score the suitability of a building to the project purposes. It is related to the "criteria" radar and bar charts in the panel below, meaning hovering specific rows will highlight the matching chart and vice versa.

Table content itself can be sorted by the different fields by clicking on the table headers; default sorting is by criteria id.

id	name	description
c1	Energy consumption	Higher consumption/m2 compared with other buildings (same use)
c2	Economic savings potential	Higher economic saving potential (According to Sherpa results and SRI)
c3	Accessibility / Information	Information availability (accountability, energy and maintanance costs, current contractual obligations, etc.)
c5	Rehabilitation needs	No interventions implemented in the past
c6	Implementation potential	Higher implementation possibilities due to: ie. Funding possibilities, no contractual obligations, etc.

Figure 6: Table "criteria"

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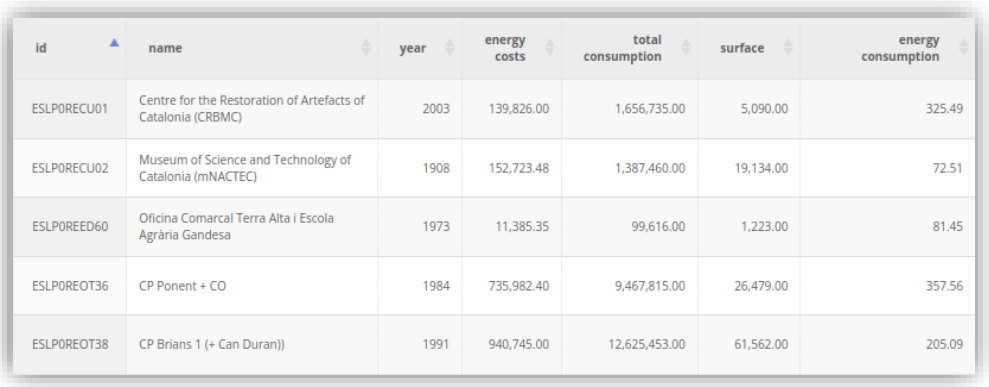
3.2.4 Table "buildings"

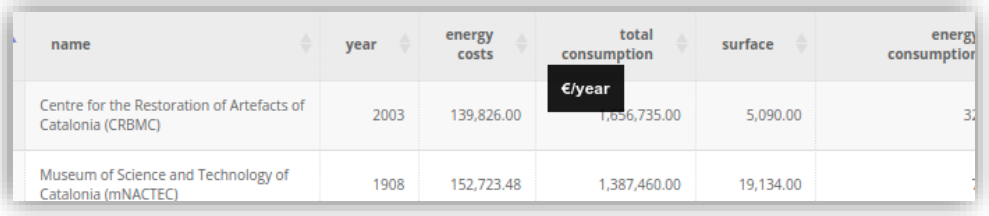
It displays information about the buildings approved for the project purposes. It is related to the "building" radar and bar charts in the panel below, meaning hovering specific rows will highlight the matching chart and vice versa.

Table content itself can be sorted by the different fields by clicking on the table headers; default sorting is by building id. Hovering over the different headers will supply information about the field units with a tooltip, if suitable.



id	name	year	energy costs	total consumption	surface	energy consumption
ESLP0RECU01	Centre for the Restoration of Artefacts of Catalonia (CRBMC)	2003	139,826.00	1,656,735.00	5,090.00	325.49
ESLP0RECU02	Museum of Science and Technology of Catalonia (mNACTEC)	1908	152,723.48	1,387,460.00	19,134.00	72.51
ESLP0REED60	Oficina Comarcal Terra Alta i Escola Agrària Gandesa	1973	11,385.35	99,616.00	1,223.00	81.45
ESLP0REOT36	CP Ponent + CO	1984	735,982.40	9,467,815.00	26,479.00	357.56
ESLP0REOT38	CP Brians 1 (+ Can Duran))	1991	940,745.00	12,625,453.00	61,562.00	205.09

Figure 7: Table "buildings"



name	year	energy costs	total consumption	surface	energy consumption
			€/year		
Centre for the Restoration of Artefacts of Catalonia (CRBMC)	2003	139,826.00	1,656,735.00	5,090.00	3
Museum of Science and Technology of Catalonia (mNACTEC)	1908	152,723.48	1,387,460.00	19,134.00	

Figure 8: Table "buildings" header hovering leads to units show

3.2.5 Chart panel

This panel allows to see building scores individually classified either by criteria or by building.

The bigger chart represents the total values for a better understanding. Additionally, the total chart can be switched to a bar-type for the same reason. More on this below.

The buttons on top of the panel allow to perform the switch between data classifications.

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Figure 9: Chart panel, information classified by criteria (default)

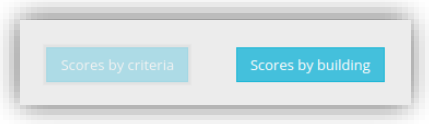

Figure 10: Switch classification buttons

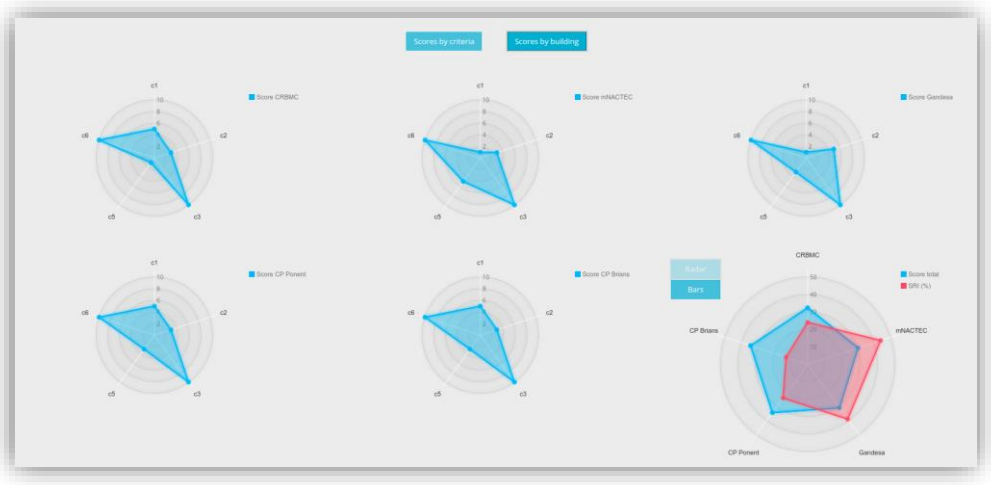

Figure 11: Information classified by building. Note the selected button and different colors

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As seen in table-map interactions, tables and radar charts are interrelated.

This means, hovering a table row will highlight the matching radar chart and vice versa. This applies to individual criteria and building charts, **not** the total, bigger ones. Please also consider that if criteria panel is selected, only criteria table rows and radar will be highlighted reciprocally. Likewise, if building classification panel is shown, interactions between tables and radar will only trigger the building items.

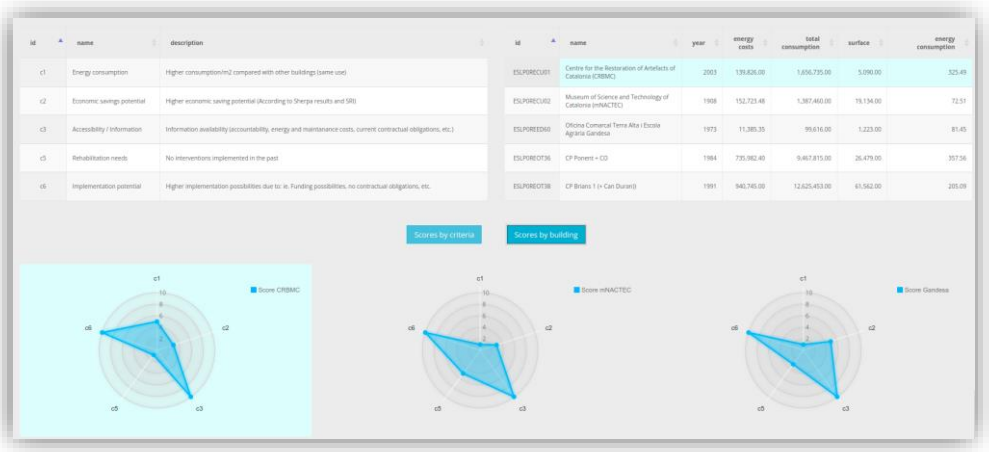

Figure 12: Reciprocal highlight, building panel

Total chart can switch between radar and bar types by using the associated buttons.

Bars chart can switch between individual or total values for an easier comparison.

Figure 13: Total radar chart, criteria panel. Note the switch button.

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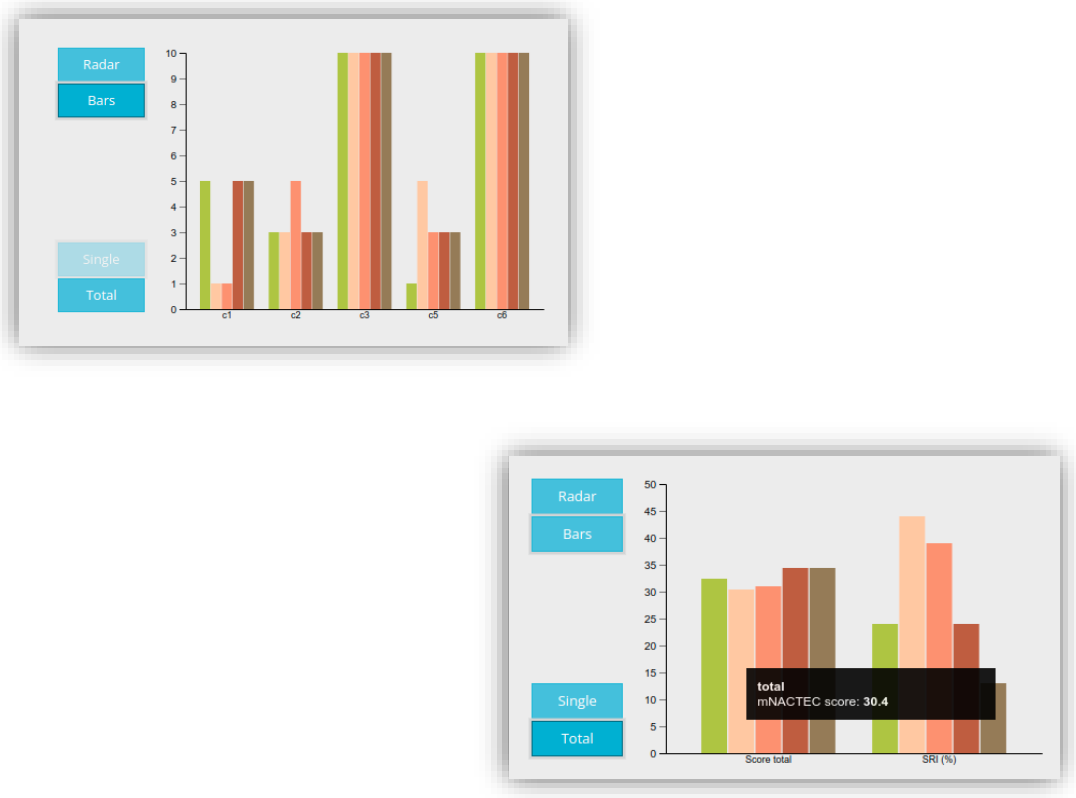

Figure 14: Individual and total bar charts, criteria panel. Note the hover tooltip in total chart.

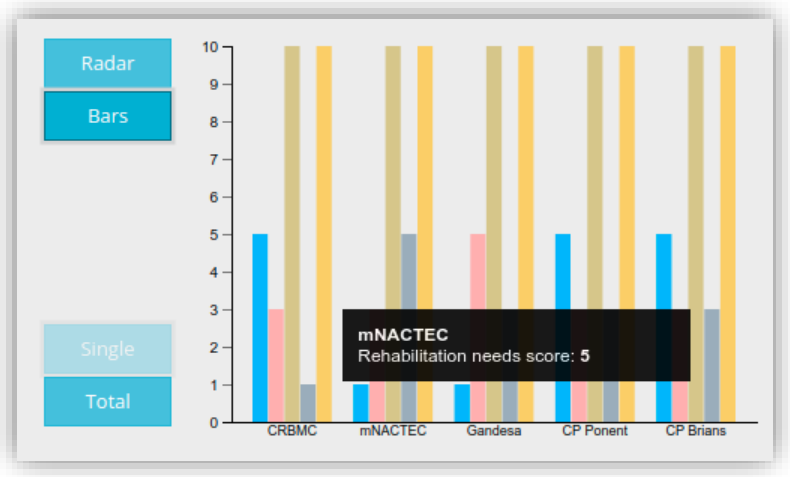

Figure 15: Total bar chart, building panel. Note the hover tooltip with criteria information.

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3.2.6 Building data monitoring

A set of dashboards is available on this section. All of them have been specifically configured to match the needs of a specific building present within the project, and they are loaded with data dynamically extracted from the specifically developed service.

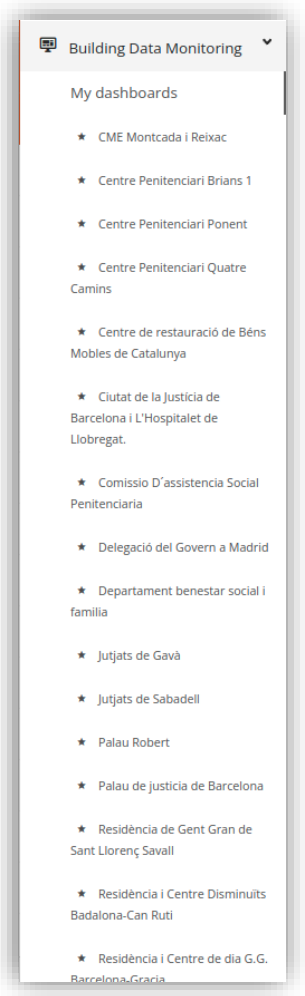

Figure 16: Access to dashboards

They are composed of a series of dynamically configurable widgets, which provide information extracted from the buildings. This kind of dashboard is modifiable by users with the administrator role.

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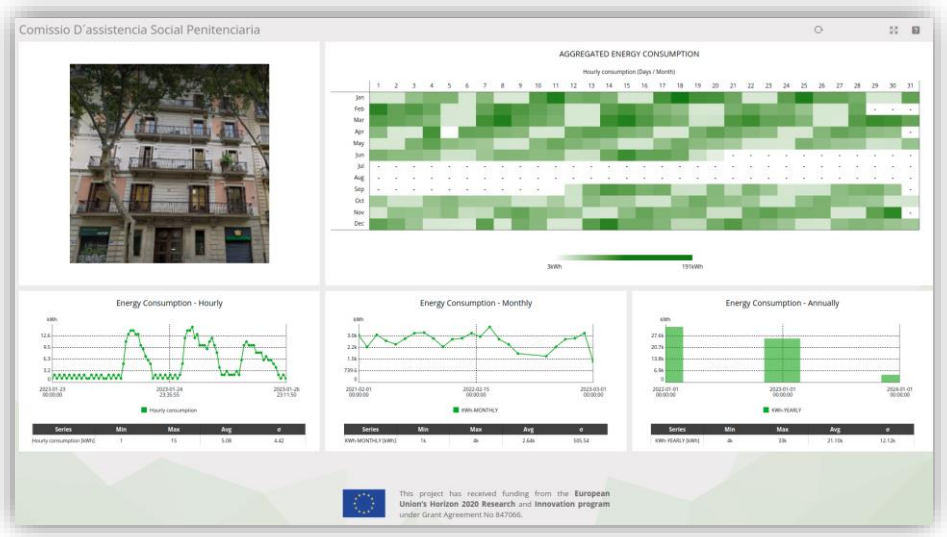

Figure 17: Example of dashboard

3.2.7 Grid friendliness indicator

Grid friendliness indicator is a dashboard tool which aims to visually present how the energy savings of a building - over a one-year period – translate into value for the grid. User loads building data in CSV format and the dashboard applies a set of coefficient matrices to its measurements. These coefficients have been calculated in the deliverable D4.2 “The drivers of the value of energy efficiency as an energy resource”.

The initial status is a simple form to load the CSV file either by dragging it or selecting it with a regular file selector.

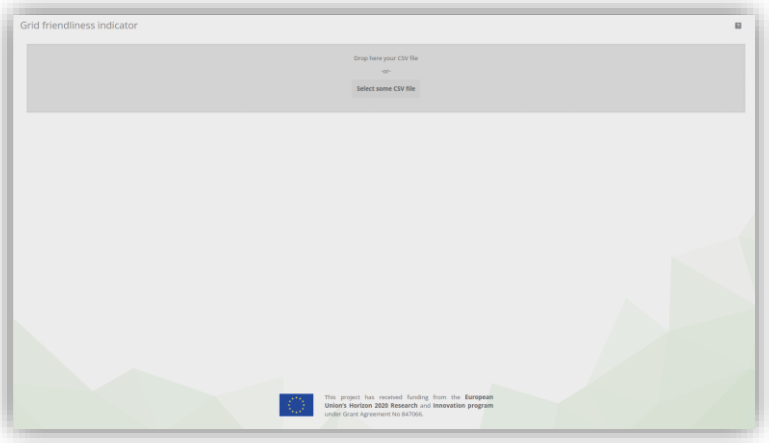

Figure 18: Grid friendliness tool initial status

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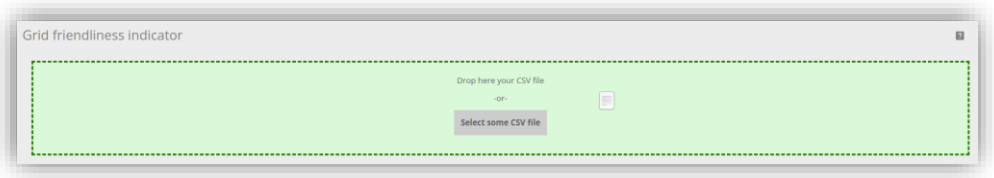

Figure 19: Load CSV file by drag-drop

3.2.8 CSV files

CSV files with buildings information are based on Zenodo data[1]. They have one reading for each hour of a year, following the example below for a correct parsing:

```
Hour_of_Year,Climate_Zone,Net_Load_Version,Building_Type,End_Use,Baseline_Load,Measure_Load,Relative_Savings
1,2A,1,LargeHotel,cooling,35.4389803323884,35.4373756593394,-2.7839071501459e-09
```

Figure 20: CSV file format

A set of pre-processed files is available for demo purposes.

Once a file has been loaded, the dashboard presents three areas of visualization, matching a) two-line chart areas to display building measurements and savings along a year, b) two heat map charts to display the results of applying the coefficients on different time scopes, and c) a right column with tables summing up the left-hand information.

[1] https://zenodo.org/record/4737655#.Y9J_NxzMJl8

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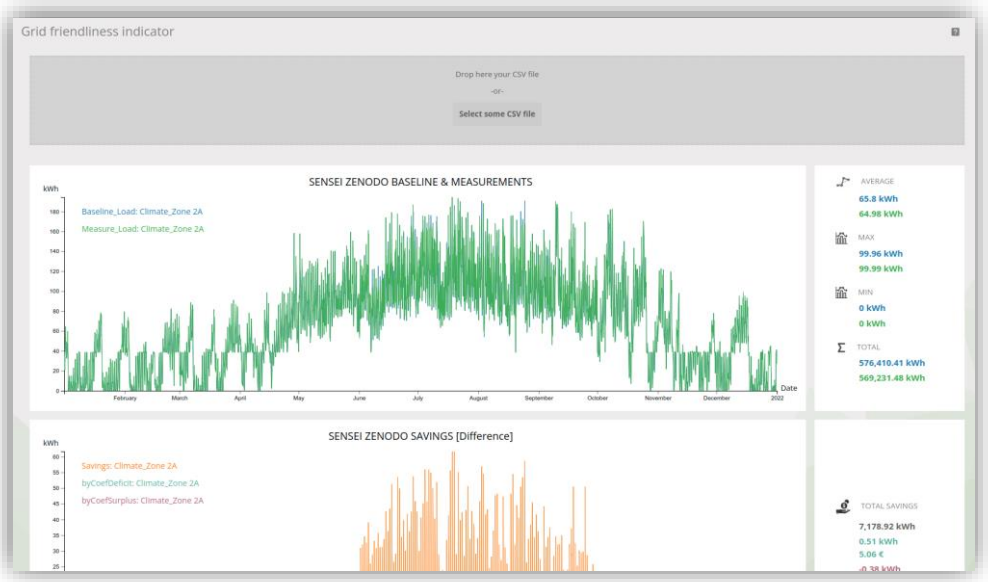

Figure 21: A sample of the structure of the grid friendliness tool (I)

Figure 22: A sample of the structure of the grid friendliness tool (II)

3.2.9 Line charts

These charts are aimed to show every year's values, approximately 8760 hours, in a continuous line representation. They are fully zoomable by using the mouse wheel. Represented

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categories can be disabled by clicking on their legends. In addition to the zoom, if more detail is required, the user can hover over the lines to display a tooltip with the specific values at that point in time.

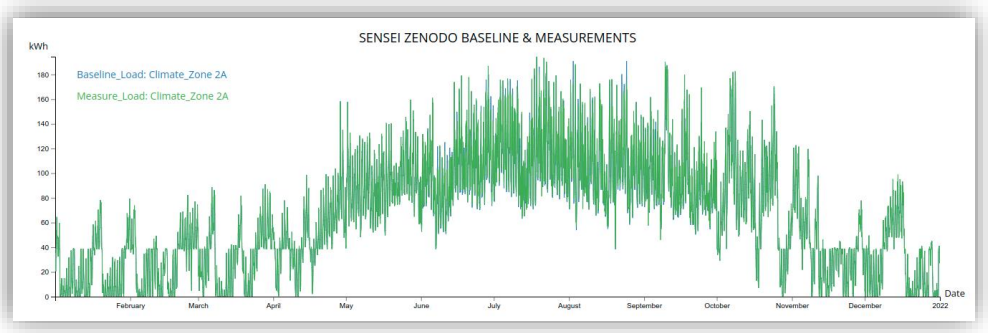

Figure 23: The first line chart

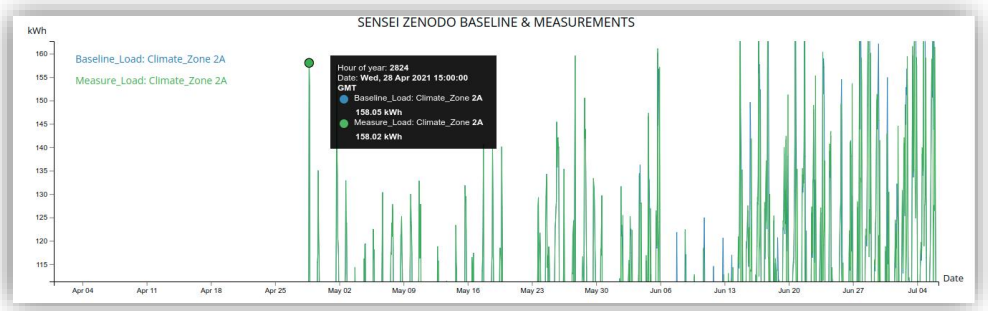

Figure 24: Zoomed line chart and hovering values

The first line chart represents the base line predicted consumption, and the measurements taken. Box at the right side displays a sum up of the values, considering total, maximum, minimum and average values along with their units.

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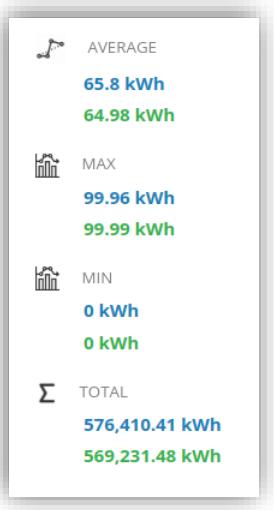

Figure 25: Summary of the first line chart values

The second line chart displays the difference between the baseline and the measured values, i.e., the savings. This second chart also shows the result of multiplying those hourly savings by the coefficient matrices, also with hour granularity. To see these results probably zoom will be necessary due to the size of the coefficients.

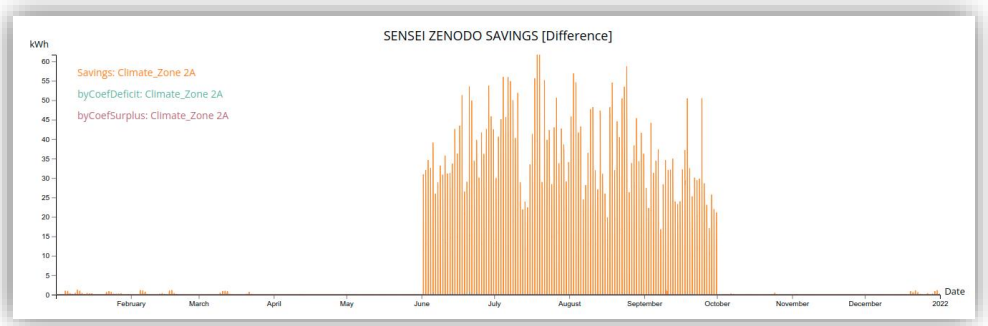

Figure 26: Second line chart, savings

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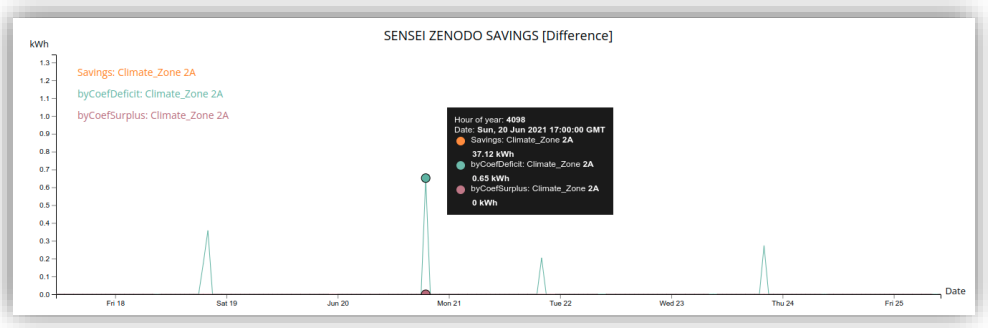

Figure 27: Zoomed savings by deficit coefficients, note the scales

The box at the right side shows an overview covering the total savings, the total savings multiplied by every deficit coefficient, and the surplus obtained applying the corresponding coefficient (per each hour of the year). They are shown both in energetic terms (kWh) and economic terms (€).

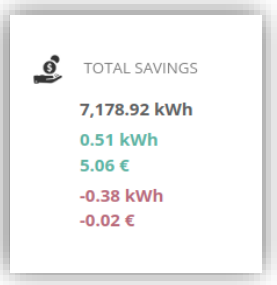

Figure 28: Summary of the savings chart. Note the deficit savings (green), the surplus savings (dull red) and the different units

3.2.10 _ Heat maps

The two heat maps available allow to display the pre-defined coefficients along with the resulting value of multiplying them by the actual savings value with different time granularities. The economic values are extracted by multiplying the calculated values by a constant which depends on the coefficient type, deficit or surplus.

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Figure 29: The heat maps with their summary tables on the right side

Mouse hover over the heat map squares will activate a tooltip with the specific values at that point. These squares are colored depending on their value with respect to the total sum of the line. The bright red squares mark the negative values, with the same stepwise representation. The green-colored squares represent deficit values, and the dull red squares represent the surplus values.

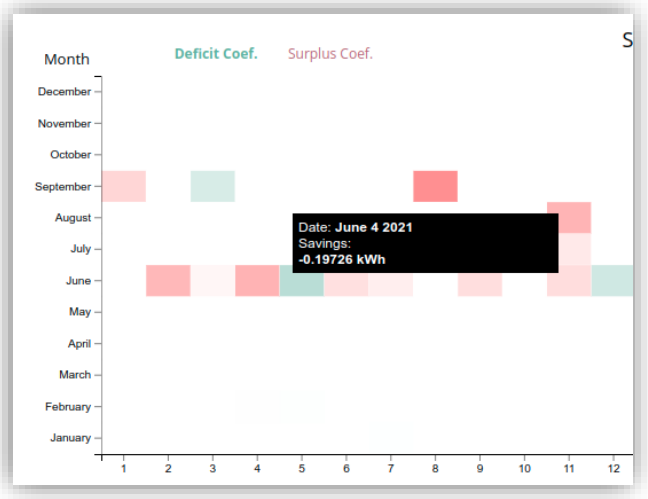

Figure 30: Detail of square hovering on the first heat map. The color grade depends on the totals. Negative values have their own gradation

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The first heat map displays the yearly distribution of the coefficients, initially with the deficit ones selected. Savings are displayed both in kWh and in euros.

TOTAL SAVINGS	kWh | €
December:	0.01467
November:	-0.00020
October:	-0.00078
September:	-1.21237
August:	-0.04391
July:	-0.26673
June:	1.98177
May:	0.00021
April:	0.00007
March:	0.00000
February:	0.01323
January:	0.01999

TOTAL SAVINGS	kWh | €
December:	0.01
November:	-0.00
October:	-0.00
September:	-1.21
August:	-0.04
July:	-0.27
June:	1.98
May:	0.00
April:	0.00
March:	0.00
February:	0.01
January:	0.02

Figure 31: Summary tables for the first heat map. Note the unit switch on the top

In the same way as the line charts, a box on the right side acts as a total value display. It contains the switches to change displayed units. A click on the surplus text will trigger the change to surplus coefficients and calculated values of **both heatmaps**. The purpose of this is to be able to compare the values.

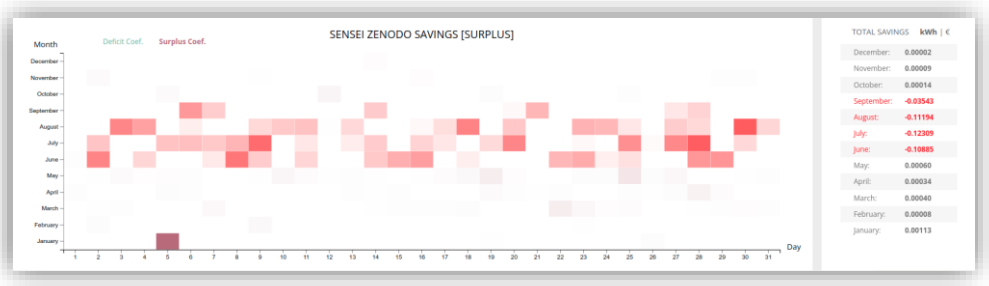

Figure 32: Surplus coefficient calculations, first heat map. Note the bold Surplus coef. Text and the changed values

The second heatmap displays the monthly distribution of the savings, multiplied either by the deficit or the surplus coefficients. A selector of the month is present in this chart, apart from

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the controls already mentioned. The change in surplus/deficit coefficients **only** affects the monthly heat map. The units can be changed the same way as seen for the first heatmap.

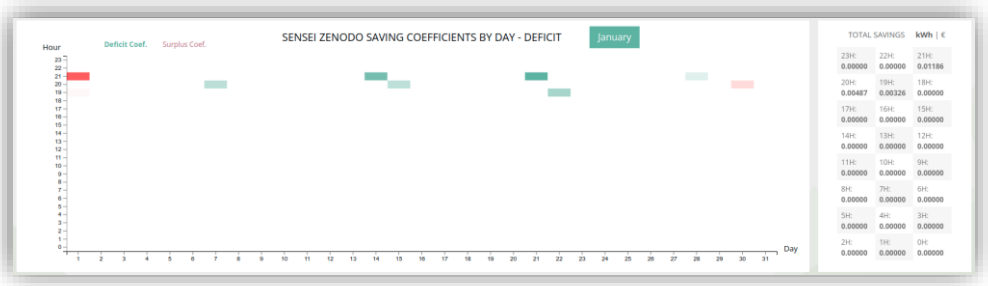

Figure 33: Second heat map, deficit values aggregated by day

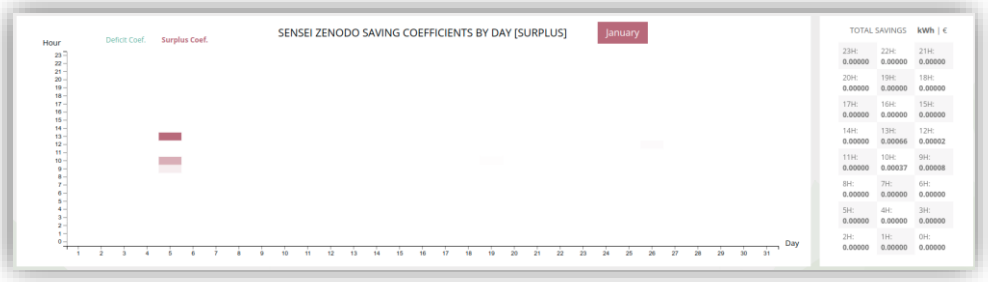

Figure 34: Second heat map, surplus values aggregated by day

In this second heat map the hovering of the squares is linked to the values on the summary table, highlighting the aggregated values with the same color.

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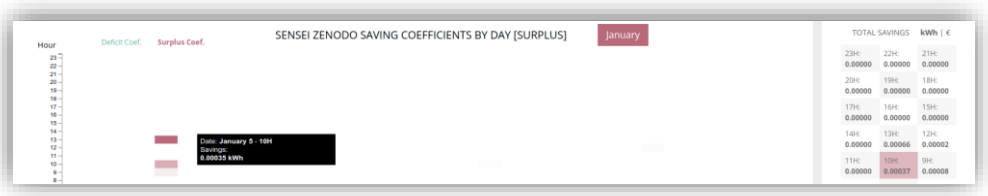

Figure 35: Examples of hovering and summary linkages

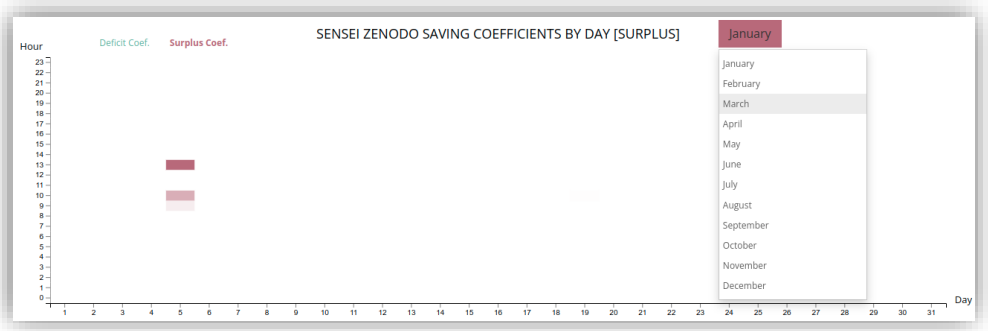

Figure 36: Month selector, second heat map

3.2.11 SRI calculator

A new tab is opened within the browser to display the SRI tool

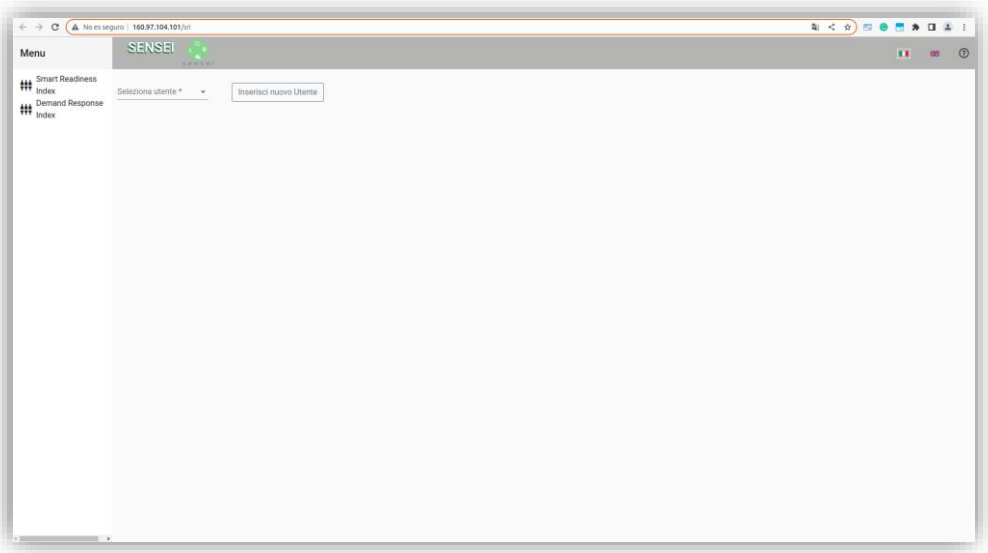

Figure 37: SRI calculator tool

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This Web app was created to collect data referring to the SRI and DR for each pilot, which can quickly calculate and share the Smartness Readiness Indicator and DR assessments and the resulting revenues from providing flexible services. It is a tool that allows to investigate interventions carried out in the field to give a measure of the value of the existing interplay between EE and DR, establishing a relationship based on the intervention of EE and allowing to say how much DR managed to, was able to provide based on EE's intervention. More details about this tool can be found in D5.4, *The interplay between P4P and demand response incentives, and guidelines for incentive design*

4 Conclusions

A document has been presented with the basic actions and knowledge needed to extract the potential from the SENSEI platform, particularly by means of its graphical assets. General, basic procedures are illustrated to deliver a comprehensive follow-up guide of the tools, as well as detailed information about the purpose of each item.

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