Smart energy services to solve the **SP**lit**IN**centive problem in the commercial rented sector

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D4.5 - SMARTSPIN DATA-PLATFORM INTEGRATION AND VISUALIZATION DASHBOARD

Due date	**01/04/2023**	**Delivery date**	
Work package	WP4 - Data analytics for energy management		
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0.2	06/04/2024	Larraitz Aranburu Eizaguirre, Iñigo López Villamor, Antonio Garrido Marijuan	Added the description of the Algorithms and integration with the EMD platform

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0.3	06/24/2024	Álvaro Diez	Added the access, roles and front-end description
0.4	08/23/2024	Álvaro Diez	Added the introduction and conclusions
0.5	09/20/2024	Antonio Garrido Marijuan, Álvaro Diez	Corrections after the initial review
0.6	09/27/2024	Luciano De Tommasi	Review
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1.0	10/10/2024	IERC	Final review and submission

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List of abbreviations

EMD	Energy Management Data
ESCO	Energy Service Company
M&V	Measurement and Verification

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EXECUTIVE SUMMARY

This deliverable outlines the development of the front-end for the Energy Management Data Platform, which has now been integrated into the Smarkia platform. The front-end consolidates data from demo sites, gathers smart-contract characteristics developed within WP3, and empowers stakeholders to visualize results generated by the data-driven algorithms created in Tasks T4.2 SmartSPIN early building diagnostics and T4.4 Data-driven prognostics for operation and control.

The report highlights the design of the front-end and the development of customized dashboards tailored to the needs of key stakeholders, including Occupants, Building/O&M Managers, Energy Service Companies (ESCOs), and Building Owners. Additionally, it details how algorithms developed under WP4 have been incorporated into the Smarkia platform, enhancing data analysis and improving decision-making capabilities.

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1 INTRODUCTION

This deliverable provides the details of the development of the front-end for the Energy Management Data (EMD) Platform, now integrated into the Smarkia platform. The front-end consolidates data from demo sites, integrates smart-contract characteristics developed in WP3, and enables stakeholders to interact with the outputs of data-driven algorithms created in Tasks T4.2 to T4.4.

The report provides an overview of the front-end design, focusing on the creation of customized dashboards for key user groups—Occupants, Building or O&M Managers, ESCOs, and Building Owners. These dashboards have been tailored to the specific needs of each group, facilitating more effective access to and interpretation of relevant data.

Subsequent sections outline how algorithms developed in WP4 have been incorporated into the platform, with a focus on their role in enhancing data analysis and supporting informed decision-making.

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2 ACCESS & ROLES

2.1 ACCESS TO THE TOOL

The tool is accessible at the URL https://energycloud.smarkia.com/. Users are required to enter their username and password:

Figure 1: Smarkia platform login screen

Once logged in to the platform, the users can access all the available metrics for their site under the Configuration tab:

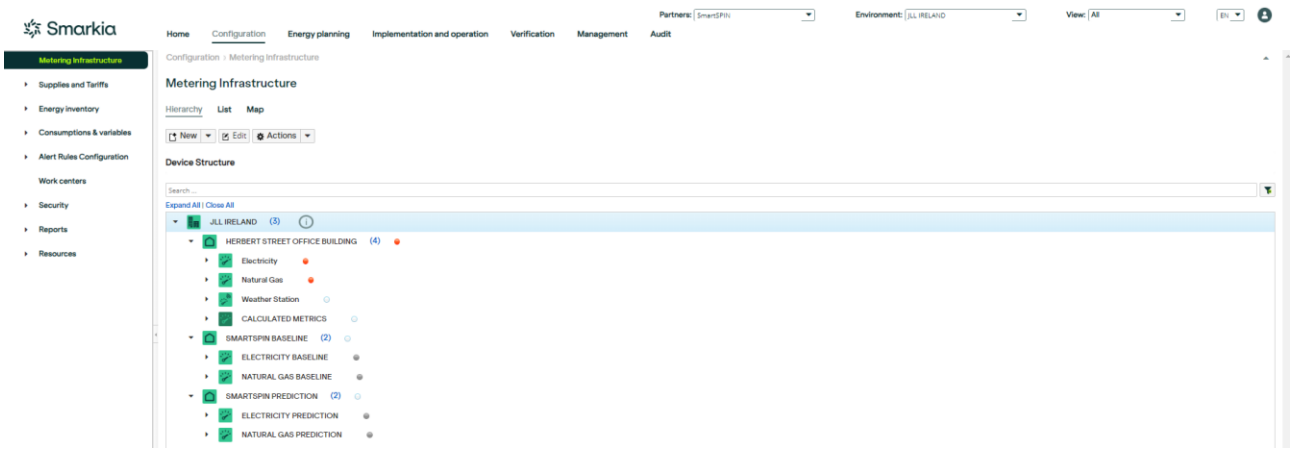

Figure 2: Illustration of the metering infrastructure on Smarkia platform

Within the home tab, under Dashboards, users can find the dashboards that have been made available for each user to access their relevant information.

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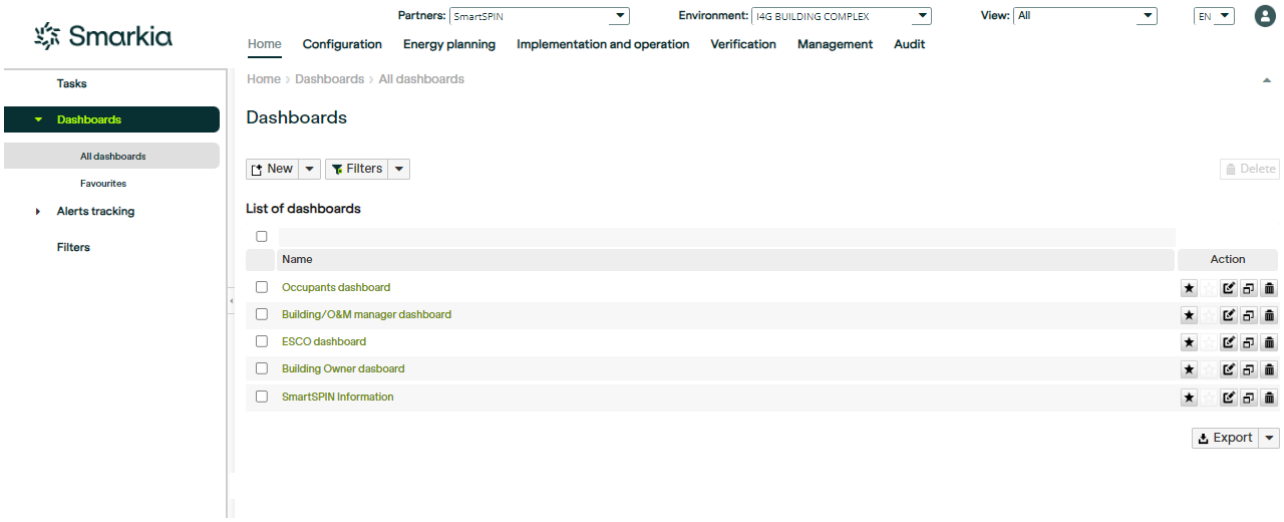

Figure 3: Illustration of the list of Dashboards on Smarkia platform

2.2 PROFILE ROLES

The profiles that have been created for each demo site to access their relevant information within each demo site are:

- Tenancies:
  - Spain:
    - User: smartspin.tenant1.lagavia@gmail.com and smartspin.tenancies.plenilunio@gmail.com
    - Password: ***** (Sent to the demo site leader in Spain for its dissemination to the appropriate person)
    - User: smartspin.tenant2.lagavia@gmail.com and smartspin.tenancies.plenilunio@gmail.com
    - Password: ***** (Sent to the demo site leader in Spain for its dissemination to the appropriate person)
    - User: smartspin.tenant3.lagavia@gmail.com and smartspin.tenancies.plenilunio@gmail.com
    - Password: ***** (Sent to the demo site leader in Spain for its dissemination to the appropriate person)
    - User: smartspin.tenant4.lagavia@gmail.com and smartspin.tenancies.plenilunio@gmail.com
    - Password: ***** (Sent to the demo site leader in Spain for its dissemination to the appropriate person)
    - User: smartspin.tenant5.lagavia@gmail.com and smartspin.tenancies.plenilunio@gmail.com
    - Password: ***** (Sent to the demo site leader in Spain for its dissemination to the appropriate person)
    - User: smartspin.tenant6.lagavia@gmail.com and smartspin.tenancies.plenilunio@gmail.com

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        - Password: ***** (Sent to the demo site leader in Spain for its dissemination to the appropriate person)
    - Greece:
        - User: smartspin.tenant1.i4g@gmail.com
        - Password: ***** (Sent to the demo site leader in Greece for its dissemination to the appropriate person)
        - User: smartspin.tenant2.i4g@gmail.com
        - Password: ***** (Sent to the demo site leader in Greece for its dissemination to the appropriate person)
        - User: smartspin.tenant3.i4g@gmail.com
        - Password: ***** (Sent to the demo site leader in Greece for its dissemination to the appropriate person)
- Building owners:
    - Spain:
        - User: smartspin.buildingowners.lagavia@gmail.com and smartspin.buildingowners.plenilunio@gmail.com
        - Password: ***** (Sent to the demo site leader in Spain for its dissemination to the appropriate person)
    - Greece:
        - User: smartspin.buildingowners.i4g@gmail.com
        - Password: ***** (Sent to the demo site leader in Greece for its dissemination to the appropriate person)
    - Ireland:
        - User: smartspin.buildingowners.jll@gmail.com
        - Password: ***** (Sent to the demo site leader in Ireland for its dissemination to the appropriate person)
- ESCOs:
    - Spain:
        - User: smartspin.escos.lagavia@gmail.com and smartspin.escos.plenilunio@gmail.com
        - Password: ***** (Sent to the demo site leader in Spain for its dissemination to the appropriate person)
    - Greece:
        - User: smartspin.escos.i4g@gmail.com
        - Password: ***** (Sent to the demo site leader in Greece for its dissemination to the appropriate person)
    - Ireland:
        - User: smartspin.escos.jll@gmail.com
        - Password: ***** (Sent to the demo site leader in Ireland for its dissemination to the appropriate person)

- Building/O&M manager dashboard
    - Spain:

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        - User: smartspin.o&m.lagavia@gmail.com and smartspin.o&m.plenilunio@gmail.com
        - Password: ***** (Sent to the demo site leader in Spain for its dissemination to the appropriate person)
    - Greece:
        - User: smartspin.o&m.i4g@gmail.com
        - Password: ***** (Sent to the demo site leader in Greece for its dissemination to the appropriate person)
    - Ireland:
        - User: smartspin.o&m.jll@gmail.com
        - Password: ***** (Sent to the demo site leader in Ireland for its dissemination to the appropriate person)

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3 FRONT-END OVERVIEW

3.1 TENANTS VISUALIZATION

For tenants to access their relevant information we have created a dashboard titled "Occupants Dashboard" which is tailored for tenants to visualize and monitor their energy performance. It provides a clear and comprehensive overview of energy consumption across different timeframes for each tenancy.

For example, below it is showcased the example of the dashboard displaying the data for the demo site in Greece, specifically for the tenancy "BUILDING 2 – SECOND FLOOR – RIGHT."

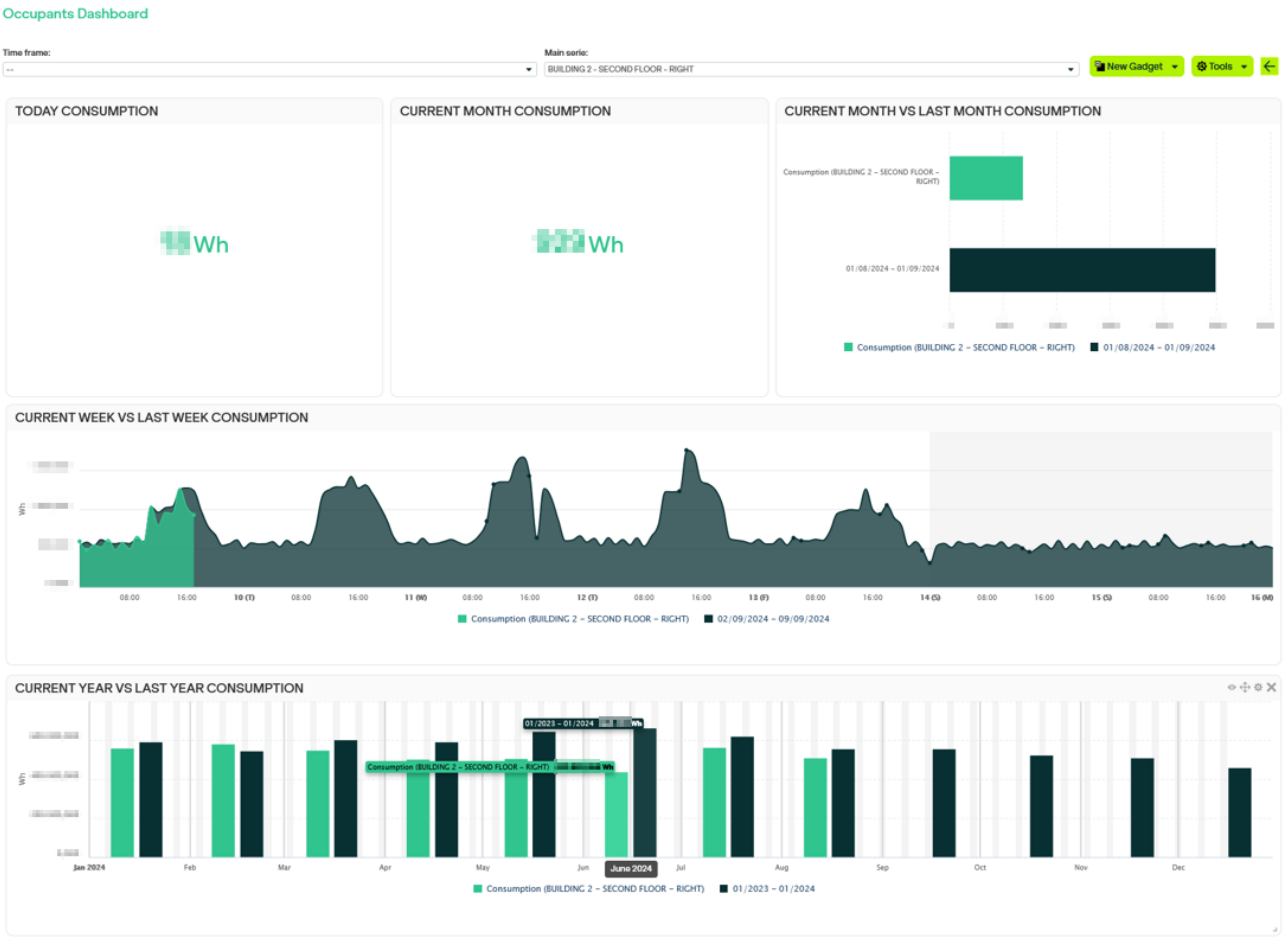

Figure 4: Example of the "Occupants Dashboard for the tenancy" for "Building 2–second floor– right" In Greece

In this case, the dashboard components are:

- Today Consumption: Displays the current energy consumption for the day. For the tenancy in the demo site in Greece, the value shows the real-time energy use, reflecting the site's daily consumption trends.
- Current Month Consumption: Shows the total energy consumption for the current month. For the tenancy in the demo site in Greece, this gives an overview of energy usage up to the present date within the ongoing month.

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- Current Month vs Last Month Consumption: This bar chart compares the energy consumption for the current month (in this case September 2024) versus the previous month (in this case August 2024). For this tenancy in the demo site in Greece, the current month's consumption is lower, with August showing a much higher value in comparison.
- Current Week vs Last Week Consumption: This line graph compares energy consumption trends over time for the current week (in this case 02/09/2024 – 09/09/2024) versus the last week. It highlights peaks and troughs in the energy usage patterns, in this case for the previously mentioned tenancy in demo site in Greece, corresponding to periods of higher occupant activity.
- Current Year vs Last Year Consumption: This bar chart compares energy consumption monthly for the current year (in this case 2024) versus the previous year (in this case 2023). The comparison for the tenancy in the demo site in Greece illustrates variations in energy usage between the two years, with some months showing reduced consumption this year compared to the previous one

This dashboard provides tenants with a detailed view of their energy consumption patterns and enables them to compare their current energy performance with historical data, helping them manage their energy usage efficiently.

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3.2 BUILDING OR O&M MANAGER VISUALIZATION

For operations and maintenance managers to access their relevant information we have created a dashboard titled "Building O&M Manager Dashboard", it is designed to help operations and maintenance managers monitor the energy performance of the building's utilities. It provides visibility into electricity and/or natural gas consumption compared to baseline values.

The data displayed for the example below is based on the demo site Plenilunio, located in Spain.

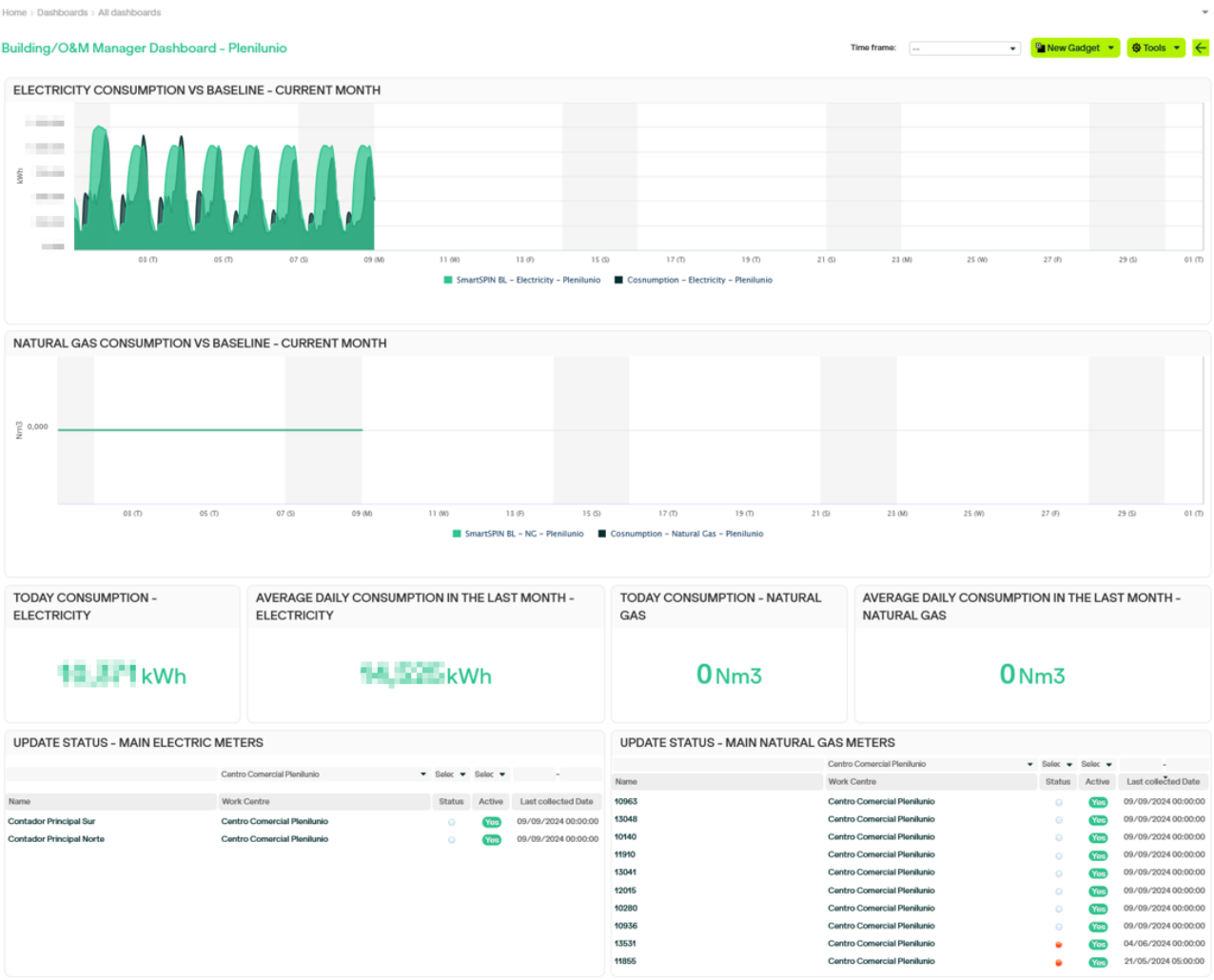

Figure 5: Example of the "Building O&M Manager Dashboard" for Plenilunio

In this case, the dashboard components are:

- Electricity Consumption vs Baseline - Current Month: This graph shows electricity consumption in kWh for the current month, compared against a baseline for the demo site in Plenilunio, Spain. The consumption shows a regular pattern with peaks and dips, indicating periods of higher usage during certain hours or days.
- Natural Gas Consumption vs Baseline - Current Month: This section tracks natural gas consumption in Nm³ compared to a baseline. In the demo site at Plenilunio, there is no current

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natural gas consumption, as both the consumption and the baseline remain at 0 Nm³ for the current month.

- Today Consumption - Electricity: This section provides the current electricity consumption for the day at the demo site in Plenilunio, indicating the ongoing energy usage for the day.
- Average Daily Consumption in the Last Month - Electricity: Shows the average daily electricity consumption for the last month at the demo site in Plenilunio, reflecting the site's typical energy usage over a recent period.
- Today Consumption - Natural Gas: Displays the current natural gas consumption for the day. For the demo site in Plenilunio, the value is 0 Nm³, indicating no gas usage for today.
- Average Daily Consumption in the Last Month - Natural Gas: Shows the average daily natural gas consumption for the last month. For the demo site in Plenilunio, this value is also 0 Nm³.
- Update Status - Main Electric Meters: This table lists the status of the main electric meters at the demo site in Plenilunio. The two meters, labeled "Contador Principal Sur" and "Contador Principal Norte," are both active, with the last collected data timestamped as 09/09/2024.
- Update Status - Main Natural Gas Meters: This table lists the status of the main natural gas meters at the demo site in Plenilunio. The meters appear to be active and operational, with the majority of meters showing recent data collection on 09/09/2024, except for one meter which was last updated in May 2024.

This dashboard provides detailed insights into the electricity and gas consumption trends at the demo site in Plenilunio, Spain, allowing facility managers to track real-time consumption and make data-driven decisions.

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3.3 ESCO VISUALIZATION

For ESCOs to visualize and track the building's energy performance we have created a dashboard named "ESCO Dashboard". It provides detailed insights into electricity and/or natural gas consumption, helping ESCOs to manage and optimize energy use.

The data shown in this example comes from the demo site La Gavia, located in Spain.

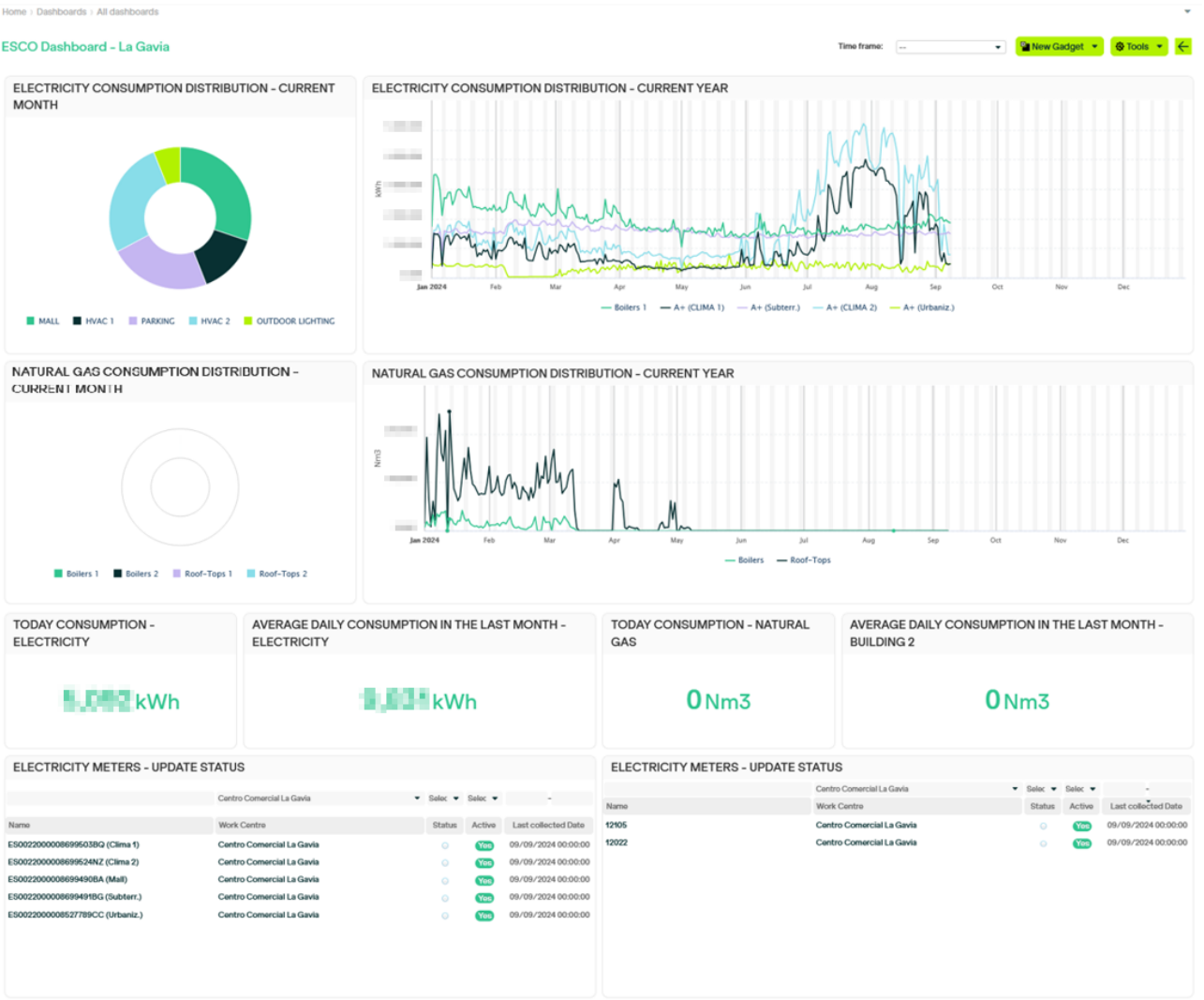

Figure 6: Example of the "ESCO Dashboard" for la Gavia

In this case, the dashboard components are:

- Electricity Consumption Distribution - Current Month: This pie chart shows the electricity consumption distribution across various zones and systems in the demo site La Gavia, including the Mall, HVAC 1, Parking, HVAC 2, and Outdoor Lighting. This allows ESCOs to assess which systems are driving the highest energy usage.
- Electricity Consumption Distribution - Current Year: This line graph tracks electricity consumption over the current year, comparing different systems such as Boilers, HVAC 1,

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HVAC 2, Parking and Outdoor lighting. The data helps ESCOs identify consumption patterns and periods of increased or decreased energy use at the demo site La Gavia.

- Natural Gas Consumption Distribution - Current Month: This pie chart shows the natural gas consumption distribution in the different sectors of the demo site La Gavia. The chart displays the consumption breakdown for Boilers 1, Boilers 2, Roof-Tops 1, and Roof-Tops 2, providing a clear view of the energy contribution from different parts of the building. In this case there is no data to be displayed since there has been no gas consumption in the last month.
- Natural Gas Consumption Distribution - Current Year: This line graph shows the natural gas consumption distribution throughout the year for systems such as Boilers and Roof-Tops at the demo site La Gavia. ESCOs can use this information to assess natural gas consumption trends and evaluate opportunities for improvement.
- Today Consumption - Electricity: Displays the total electricity consumption for the current day at the demo site La Gavia, providing insight into the day's energy usage.
- Average Daily Consumption in the Last Month - Electricity: Shows the average daily electricity consumption over the last month at the demo site La Gavia, offering a view of typical energy usage for the site.
- Today Consumption - Natural Gas: Displays the total natural gas consumption for today. At the demo site La Gavia, no natural gas is being used today, showing 0 Nm^3.
- Average Daily Consumption in the Last Month - Natural Gas: This metric provides the average daily natural gas consumption over the past month for the demo site La Gavia, which in this case is 0 Nm^3.
- Electricity Meters - Update Status: This table shows the status of the electricity meters at the demo site La Gavia. The meters include systems like Clima 1, Clima 2, Subterranean, and Urbania, with data last collected on 09/09/2024.
- Natural Gas Meters - Update Status: This table monitors the update status of Building 2. Most meters are active and updated recently, except for one meter that has not been updated for a long period.

This dashboard helps ESCOs to track energy consumption performance and analyze trends across building systems, enabling informed decisions to improve energy efficiency at the demonstration sites.

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3.4 BUILDING OWNER VISUALIZATION

For building owners to visualize and track data related to energy and gas consumptions we have created a dashboard named "Building Owner Dashboard", which allows them to monitor the overall performance of their buildings, assess their energy usage over time and compare it with past consumption for more informed decision-making

The data shown in this example comes from the demo site in Ireland.

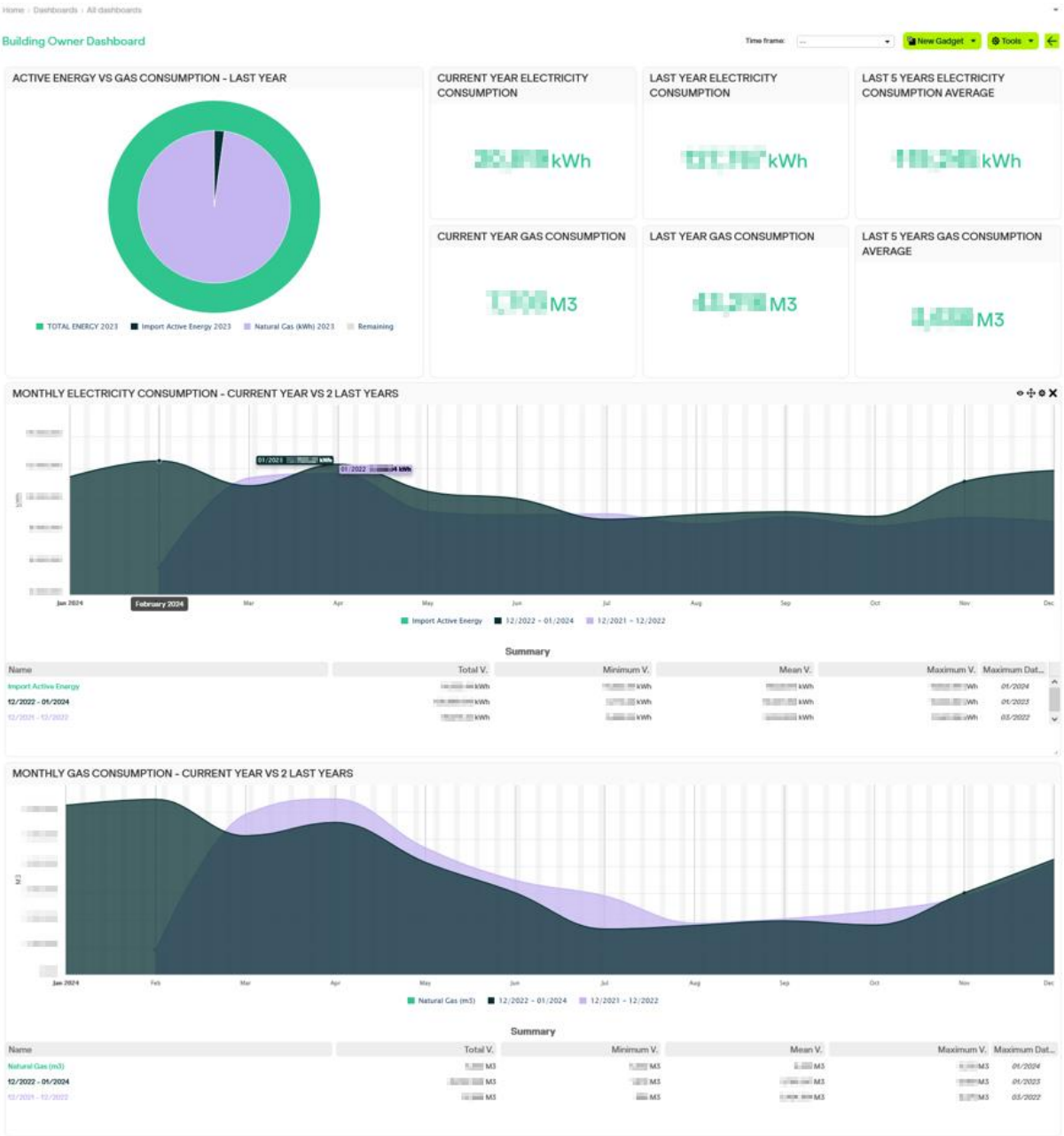

Figure 7: Example of the "Building Owner Dashboard" for the Irish demo site

In this case, the dashboard components are:

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- Active Energy vs Gas Consumption - Last Year: This pie chart illustrates the proportion of Total Energy, Import Active Energy, Natural Gas (Nm^3), and Remaining energy for the last year. It provides building owners with a clear picture of the relative consumption of different energy sources within their property.
- Current Year Electricity Consumption: Displays the total electricity consumption for the current year, giving insight into the building's ongoing energy usage and helping building owners track their electricity consumption.
- Last Year Electricity Consumption: Shows the total electricity consumption from the previous year. This metric allows building owners to compare their current performance with the previous year's energy usage
- Last 5 Years Electricity Consumption Average: This field shows the average electricity consumption over the past 5 years, enabling building owners to understand long-term trends and patterns in electricity usage.
- Current Year Gas Consumption: Displays the total gas consumption for the current year, allowing the building owner to monitor their natural gas usage.
- Last Year Gas Consumption: Shows the total gas consumption from the previous year, allowing building owners to observe any increase or decrease in natural gas consumption compared to last year.
- Last 5 Years Gas Consumption Average: This value represents the average gas consumption over the past 5 years. It enables building owners to track long-term trends or improvements in gas consumption efficiency.
- Monthly Electricity Consumption - Current Year vs Last Years: This line graph compares monthly electricity consumption for the current year against the last two years. The chart shows peaks and dips in consumption, helping building owners identify periods of high energy usage and compare it to historical data. The total values for each period are also summarized in a table below the graph.
- Monthly Gas Consumption - Current Year vs Last Years: This graph tracks monthly natural gas consumption, comparing the current year with the past two years. The graph visualizes the gas usage trends, highlighting periods where consumption was higher or lower. A summary table beneath the graph provides detailed values for each period.

This dashboard gives building owners a clear, data-driven view of their building's energy and gas performance, enabling them to make informed decisions to optimize energy efficiency and reduce costs.

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3.5 PROCESSES AND SMART-CONTRACT CHARACTERISTICS

The dashboard "SmartSPIN Info", designed for all stakeholders involved in the project (tenants, building owners, O&M teams, and ESCOs) serves as a central hub to access project information, business models, and download templates like the contractual and flexible tariff templates. It simplifies engagement by providing visual representations of business models and contractual frameworks, ensuring all parties have the necessary information to participate in the project.

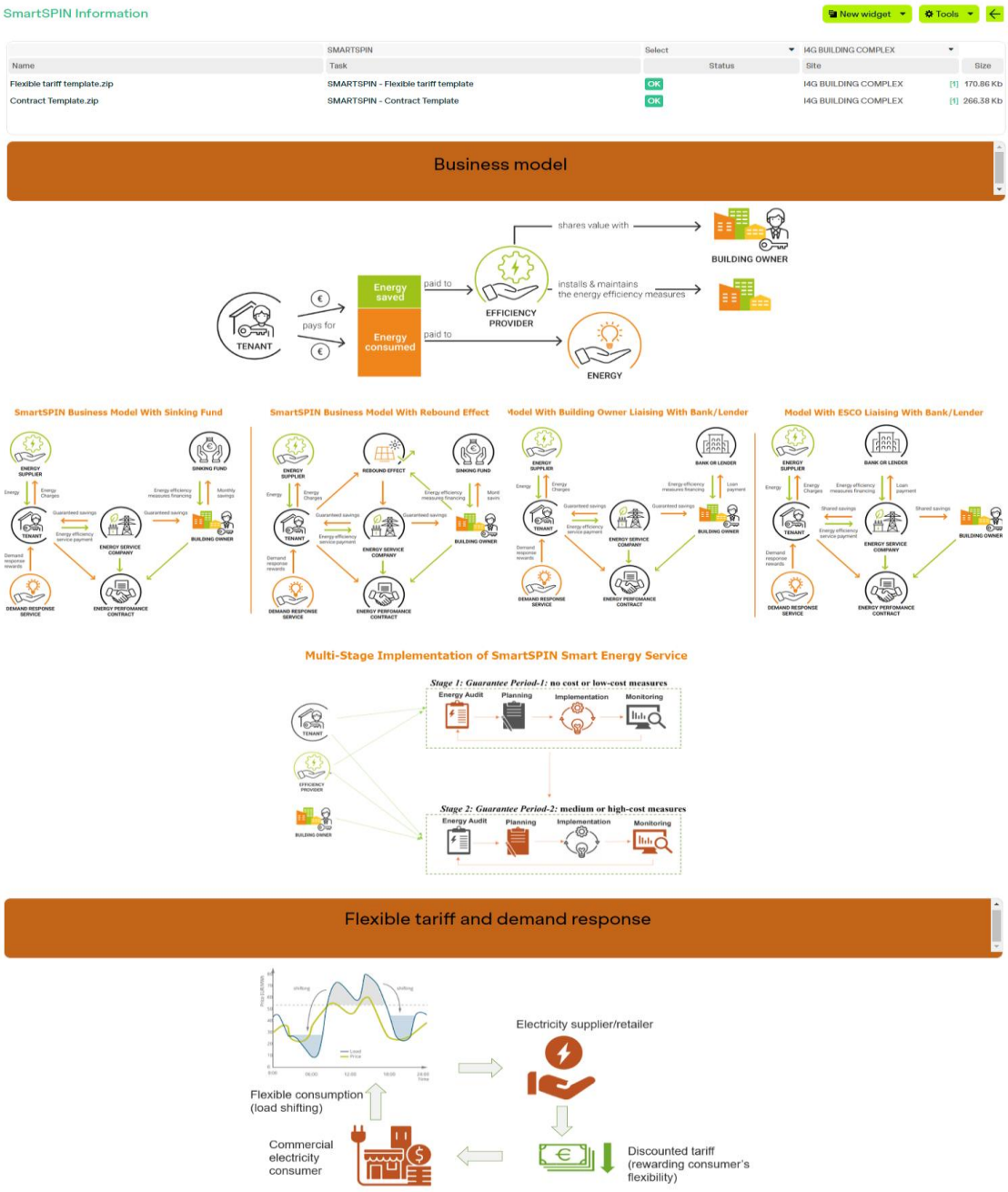

Figure 8: Example of the "SmartSPIN info Dashboard" for all stakeholders

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- File Downloads Section: At the top of the dashboard, there is a section where stakeholders can download important templates. The files available for download include:
    - Flexible Tariff Template
    - Contractual Template

  This feature allows stakeholders such as building owners, tenants, and ESCOs to easily access the necessary documents to implement flexible tariffs and energy performance contracts.

- Business Model and Contractual Template: This section visually represents the business models through four distinct diagrams, showing the interactions between various stakeholders (tenants, building owners, energy suppliers, ESCOs, and banks/lenders). The diagrams outline the flow of energy, payments, and financing, helping stakeholders understand their roles and the financial mechanisms in place.
    - The first diagram shows the traditional model, where the energy service company guarantees savings and provides energy efficiency services.
    - The second, third and fourth diagrams depict shared savings models, where both the energy service company and building owner share in the energy savings and introduce the concept of a sinking fund, showing how energy efficiency measures can be financed through savings and a demand response service. This includes participation in demand response programs that reward tenants for adjusting their energy usage.

- Flexible Tariff and Demand Response: This section explains how flexible tariffs and demand response work, providing a visual breakdown of how commercial electricity consumers can adjust their consumption (through load shifting) to take advantage of discounted tariffs.
  The graph at the bottom left shows a flexible consumption profile with load shifting to better align consumption with lower tariff periods. This setup benefits both the commercial consumer and the electricity supplier/retailer, who provides a discounted tariff as a reward for the consumer's flexibility.

Overall, this dashboard is aimed at providing all stakeholders involved in the SmartSPIN project with the tools and information needed to engage in energy performance contracts, flexible tariffs, and demand response initiatives.

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4 DATA-DRIVEN ALGORITHMS IMPLEMENTED

The EMD Platform integrates not only the relevant data from the sites and the processes and smart-contract characteristics developed within WP3, but also the data-driven algorithms developed in T4.2 and T4.4 to assist the demo coordinators with the energy baseline and prognosis.

As the algorithms have been developed as platform agnostic, the integration within the EMD Platform has been possible via API through the SMARKIA platform as another module, with an exchange of information among the data collected and stored in the SMARKIA platform and the data-driven tools developed in T4.2 and T4.4. The outcomes of the algorithms are further visualized in the SMARKIA platform to support energy management of the different demos.

4.1 INTEGRATION WITHIN THE EMD PLATFORM

SMARKIA has granted access to TECNALIA via API with specific passwords and tokens to:

- Download data, both historical and instantaneous values, via GET.
- Send calculated values obtained with the algorithms developed by TECNALIA, via PUT.

These calculated values obtained with the algorithm developed in T4.2 and T4.4 are made available through SMARKIA's platform as seen in next figure:

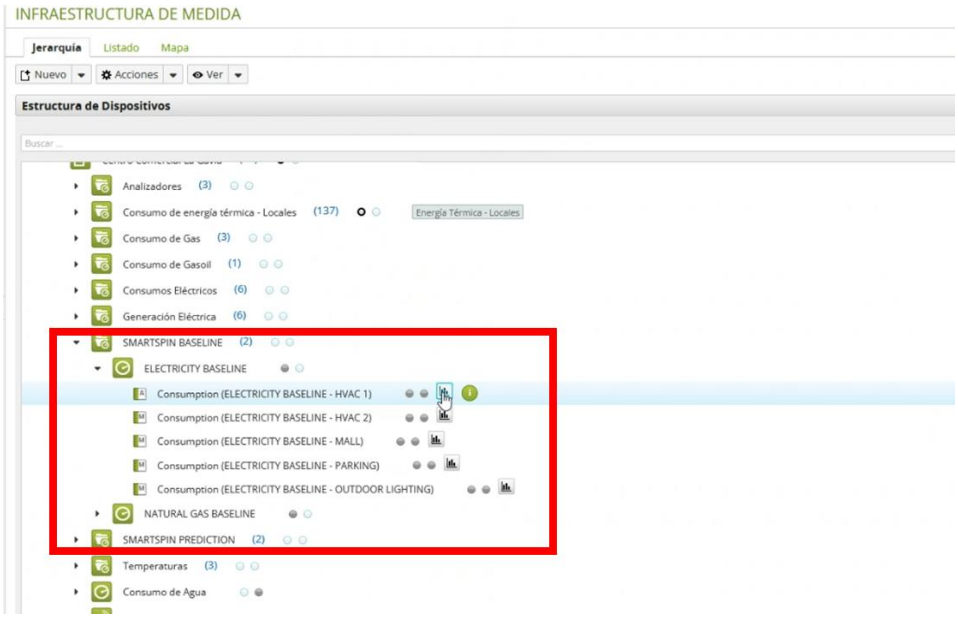

Figure 9. Access through SMARKIA's platform to the outputs of the algorithms for the baseline and prognosis.

4.1.1 Integration of the baseline calculation

As explained in D4.2, the baseline assesses the correlation of the energy loads with the boundary conditions, specifically weather parameters (outdoor temperature, HDD, etc.). To calculate energy baseline for the different demos, historic data corresponding to the energy loads is downloaded for one year of data. In parallel, weather data is downloaded for the same period with daily granularity.

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The year used as reference is the one which was selected during the proposal or, in absence of data from that period, the latest data available. Consumption data of that reference period is used to compare, measure and verify the impact of the SmartSPIN project and the associated interventions. This reference year differs from each demo and is as follows:

Table 1 Reference year for the calculation of the baseline.

Demo-site	Reference year
Spanish demosite 1: La Gavia	2019
Spanish demosite 2: Plenilunio	2019
Irish demosite	2022
Greek demosite	2023

The baseline is calculated for the situation pre-intervention (this is, prior to the interventions carried out during the SmartSPIN project). Daily mean outdoor temperature is downloaded from weatherbit.io, and applying the algorithms developed in T4.2 and T4.4, the corresponding energy load value for the pre-SmartSPIN situation for each day is calculated.

The interconnection algorithm-EMD PLATFORM allows to send, via PUT, the calculated daily energy load from the pre-intervention status with the following format:

```
{
    'title': 'Baseline",
    'data': {
                        'date': '2024-05-16T00:00:00.000000Z',
                        'estimated_consumption': 332.17519,
                        'unit': 'kWh'
            },
    'type': 'INFORMATIVE',
    'description': 'json',
    'publicComment': 'true'
}
```

This reference value could be compared with the monitored value post-intervention to Measure & Verify (M&V) the reduction of energy for each day. The access through the platform is as follows:

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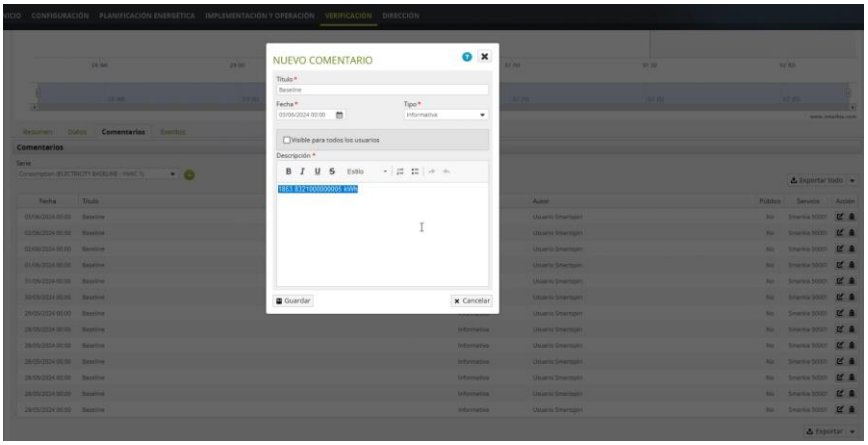

Figure 10. Access through SMARKIA's platform to the outputs of baseline algorithms, showing the estimated energy consumption for the baseline period for the weather conditions of the selected day.

On this regard, it is important to remark that for those baselines not climate-dependent, the calculation of the daily average consumption lacks practical sense as they are almost constant, as we can observe in Figure 11.

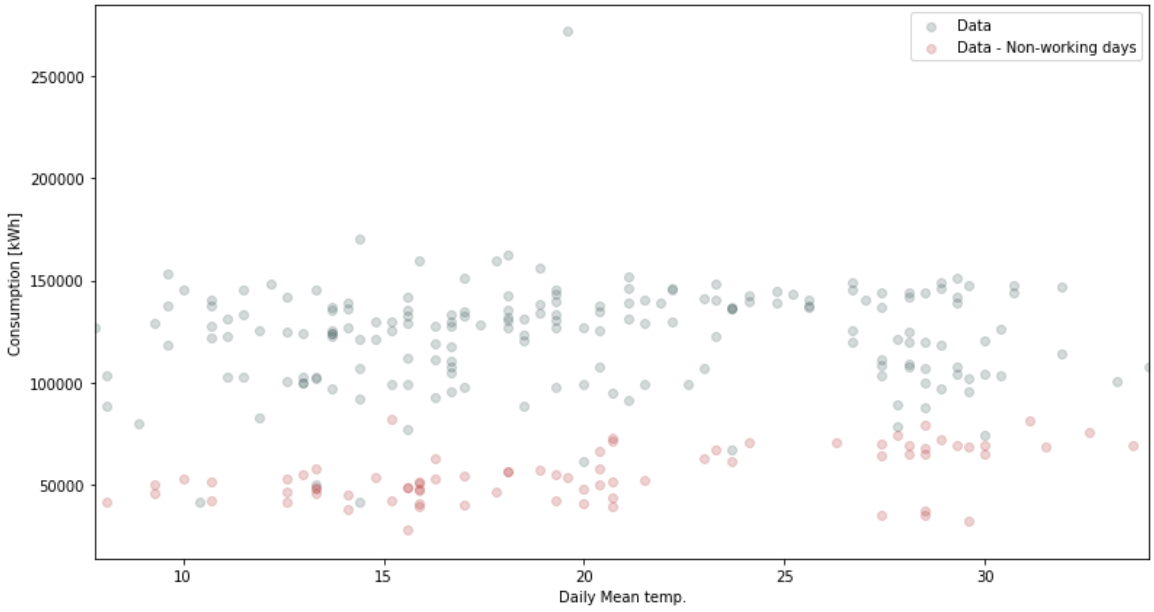

Figure 11. Energy baseline for Building 2 at Greek demosite. It can be observed that energy loads are no climatic-dependent of outdoor temperature, with a constant value in the range 75-15MWh/day.

This is the case in those spaces without HVAC. For example, in the case of parking consumption in La Gavia demo, it corresponds mainly to lighting, which is practically linear. The SmartSPIN could have an impact on those spaces which energy loads are not climatic-dependent, but to calculate this impact average values for a cycle of operation are enough for M&V purposes.

The summary of IDs from the SMARKIA platform for the interconnection with the algorithms are presented below:

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Table 2 Summary of IDs for GET and PUT for the baseline on the different demos.

DEMO	System	ID – GET	ID - PUT	Comments
LA GAVIA	CLIMA 1	M1979384	M2357026	-
LA GAVIA	CLIMA 2	M1979394	M2380760	-
LA GAVIA	MALL	M1979404	M2380762	-
LA GAVIA	SUBTERR.	M1979414	-	Not calculated as is not climatic-dependent
LA GAVIA	URBANIZ.	M1979424	-	Not calculated as is not climatic-dependent
PLENILUNIO	Consumo Total	M2380779	M2357028	-
Irish demo	Electric consumption	It is not downloaded via API	M2357016	
Irish demo	Gas Consumption	It is not downloaded via API	M2357022	
Greek demo	Total consumption	It is not downloaded via API	-	Not calculated as is not climatic-dependent

4.1.2 Integration of the prognosis calculation

The models applied to perform the prognosis calculation are the ones developed in T4.4 and explained in detail in D4.4. To have models that characterize the current behavior of each demo, a period of one year's duration that represents the actual building behavior is required to train those models.

If the building or the evaluated system modify their behavior (for example, upgrading the HVAC systems, modification of the operating point, increase or decrease of occupation), new data should be downloaded to develop the new prognosis models (check D4.4 for more information on how the models are constructed).

The models are ARX models that relate the current value of a time series to past values of the same series (autoregressive) and current and past values of the exogenous variables. Therefore, to launch short term predictions ahead the current day (6, 12 and 24h ahead), the last value of the previous day of consumption and set setpoint temperature, when the analysis requires it, must be downloaded. This is done automatically at 5AM UTC, to guarantee that the platform is updated with the latest results, as agreed with SMARKIA according to their schedule of data upload.

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Predictions of future consumption on the short term are generated considering also weather forecast, calendar and predicted occupancy. Climatic data on hourly basis is extracted from weatherbit.io[1] at the moment of launching the prediction. Together with the downloaded data for previous time steps, the algorithms would predict the future energy consumption if no actions were taken to avoid peaks. The access through the platform to this information is as follows:

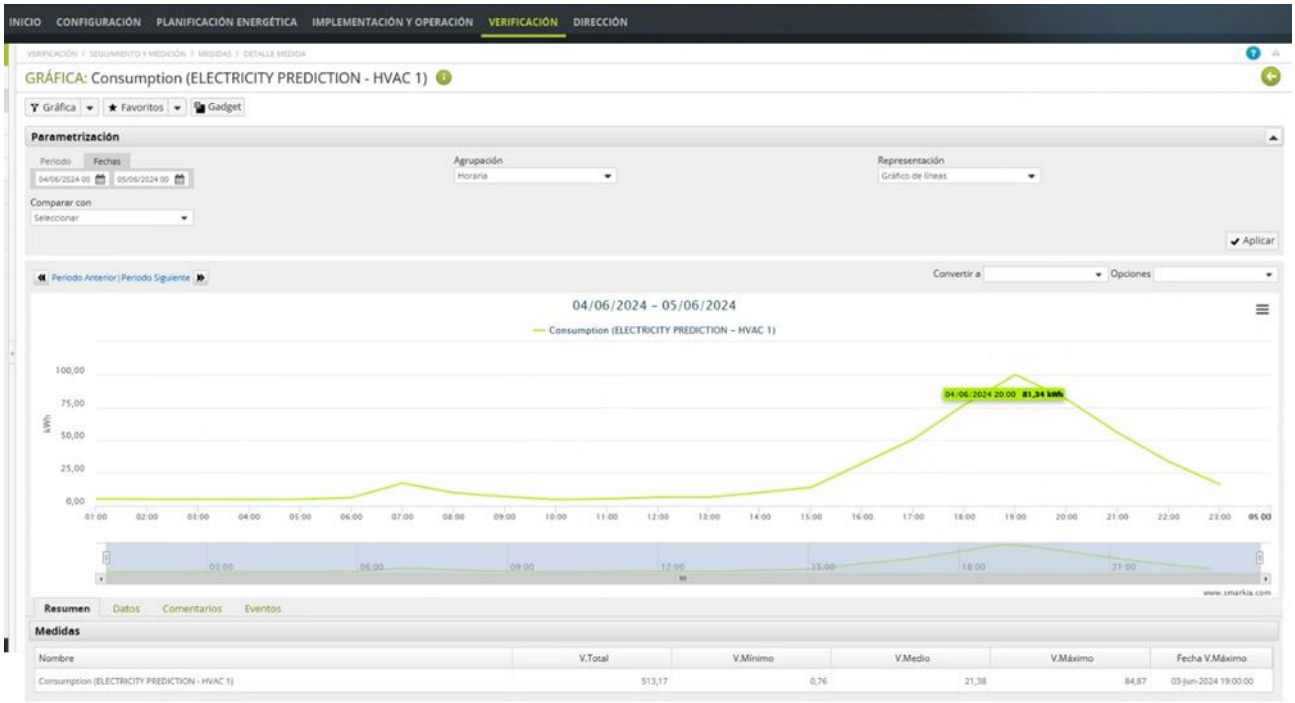

Figure 12. Access through SMARKIA's platform to the outputs of prognosis algorithms, showing the predicted energy consumption for the day ahead based on the predicted weather conditions. It shows the hourly consumption with a graph plus information on the minimum, maximum and average consumption.

Prognosis is also shown in table format with hourly predictions for the day ahead, as seen in next picture.

[1] Historical Weather API | Weatherbit

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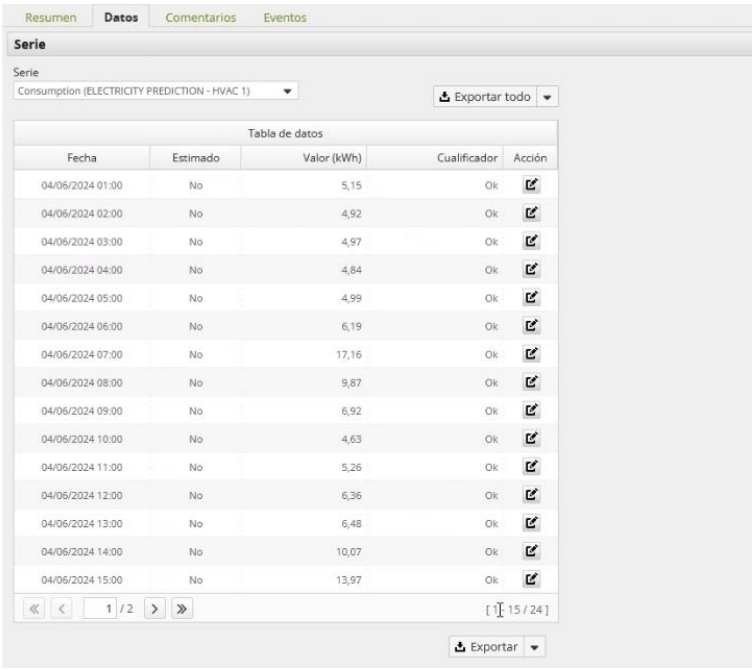

Figure 13. Prognosis is also shown in table format with hourly predictions for the day ahead.

The PUT Rest method will include the time (a 3-hour period) where the consumption peak is expected, for example:

"Maximum energy consumption 3h period is from 10.00 to 29.00. Energy consumption during this period: 161.69 kWh"

The recommendations are sent as follows:

{

"title": " Expected peak consumption",

"data": {

"start_hour": "2024-05-03 19:00:00+00:00",

"end_hour": "2024-05-03 22:00:00+00:00",

"max_consumption": "161.6937117752255"

"unit": "kWh",

"prediction": "[

{'date':'2024-05-03T00:00:00.000000Z', 'temperature':9.3,'radiation':0.0,'prediction':5.3176295952},

{'date':'2024-05-03T01:00:00.000000Z', 'temperature':8.5,'radiation':0.0,'prediction':5.6063020156},

{'date':'2024-05-03T02:00:00.000000Z', 'temperature':7.5,'radiation':0.0,'prediction':5.2635744053},

{'date':'2024-05-03T03:00:00.000000Z', 'temperature':6.3,'radiation':0.0,'prediction':5.5511644375},

{'date':'2024-05-03T04:00:00.000000Z', 'temperature':5.6,'radiation':0.0,'prediction':5.2453748952},

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{'date':'2024-05-03T05:00:00.000000Z', 'temperature':6.0,'radiation':0.0,'prediction':5.7539786419},

{'date':'2024-05-03T06:00:00.000000Z', 'temperature':5.7,'radiation':94.86,'prediction':5.2105791039},

{'date':'2024-05-03T07:00:00.000000Z', 'temperature':7.2,'radiation':284.96033,'prediction':1.9625943053},

{'date':'2024-05-03T08:00:00.000000Z', 'temperature':9.6,'radiation':484.88,'prediction':6.8647899858},

{'date':'2024-05-03T09:00:00.000000Z', 'temperature':12.1,'radiation':668.18,'prediction':4.4045395552},

{'date':'2024-05-03T10:00:00.000000Z', 'temperature':14.2,'radiation':816.41,'prediction':10.8622252427},

{'date':'2024-05-03T11:00:00.000000Z', 'temperature':15.7,'radiation':916.03,'prediction':8.2771431681},

{'date':'2024-05-03T12:00:00.000000Z', 'temperature':16.9,'radiation':958.29,'prediction':9.1910870023},

{'date':'2024-05-03T13:00:00.000000Z',
'temperature':17.9,'radiation':931.9912,'prediction':12.1836255172},

{'date':'2024-05-03T14:00:00.000000Z', 'temperature':18.7,'radiation':861.53,'prediction':12.1789456984},

{'date':'2024-05-03T15:00:00.000000Z', 'temperature':19.2,'radiation':659.72186,'prediction':9.77550584},

{'date':'2024-05-03T16:00:00.000000Z',
'temperature':19.3,'radiation':543.91675,'prediction':11.1516571926},

{'date':'2024-05-03T17:00:00.000000Z', 'temperature':18.7,'radiation':118.187,'prediction':24.6396186342},

{'date':'2024-05-03T18:00:00.000000Z',
'temperature':17.9,'radiation':164.66917,'prediction':41.8212631821},

{'date':'2024-05-03T19:00:00.000000Z', 'temperature':16.8,'radiation':24.64,'prediction':55.082079231},

{'date':'2024-05-03T20:00:00.000000Z', 'temperature':15.3,'radiation':0.0,'prediction':59.0305978414},

{'date':'2024-05-03T21:00:00.000000Z', 'temperature':14.2,'radiation':0.0,'prediction':47.5810347028},

{'date':'2024-05-03T22:00:00.000000Z', 'temperature':13.3,'radiation':0.0,'prediction':26.5059077805},

{'date':'2024-05-03T23:00:00.000000Z', 'temperature':12.6,'radiation':0.0,'prediction':11.7673715016}]'

},

"type": "INFORMATIVE",

"description": "json",

"publicComment": true

}

This information is shown as follows:

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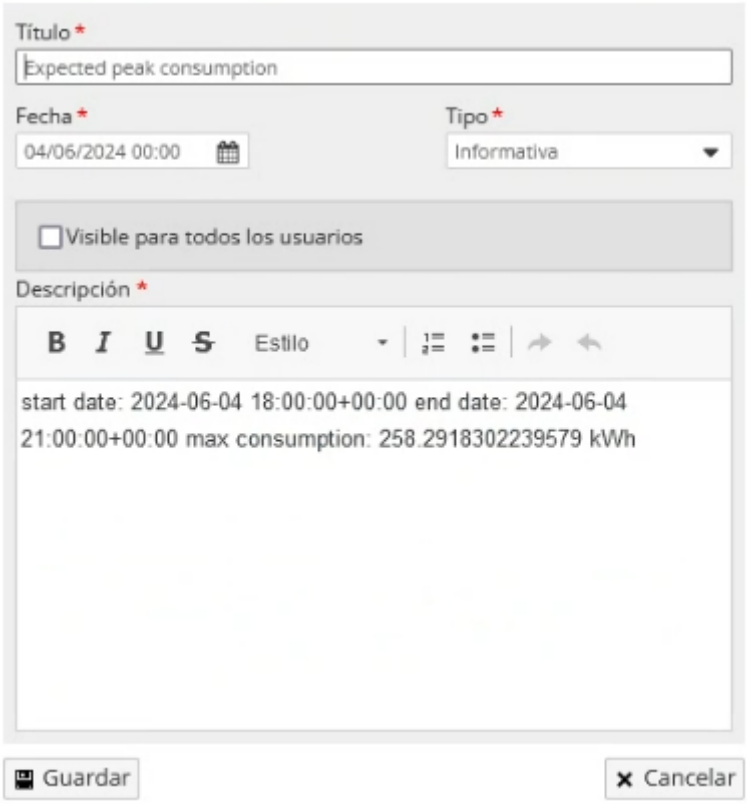

Figure 14. Information about expected peak consumption is shown through SMARKIA's platform.

The summary of IDs from the SMARKIA platform for the interconnection with the algorithms are presented below:

Table 3 Summary of IDs for GET and PUT for the prognosis on the different demos.

DEMO	System	ID - GET	ID del PUT
LA GAVIA	CLIMA 1	M1979384	M2357034
LA GAVIA	CLIMA 2	M1979394	M2380768
LA GAVIA	MALL	M1979404	M2380770
LA GAVIA	SUBTERR.	M1979414	M2380772
LA GAVIA	URBANIZ.	M1979424	M2380774
PLENILUNIO	Consumo Total	M2380779	M2357038

With regards with the Irish and Greek demo, some connection issues were encountered, and no current data can be downloaded from these demos, so no prognosis could be calculated.

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5 CONCLUSIONS

A front-end interface has been successfully developed in the EMD Platform, that consolidates data from the demo sites and incorporates the data-driven algorithms developed in WP4. It also facilitates efficient energy management for key stakeholders, including tenants, building owners, O&M managers, and ESCOs.

The implementation of customized dashboards tailored to each stakeholder group allows for precise tracking and visualization of energy performance. These dashboards enable stakeholders to access relevant data, compare energy consumption against baselines, and forecast future energy demands, promoting informed decision-making and improved energy efficiency.

Through the integration of algorithms for baseline and prognosis calculations, the platform enhances its predictive capabilities, allowing for effective monitoring of energy use and identification of consumption peaks. This predictive power not only helps to improve operational efficiency but also contributes toward significant cost savings and sustainability goals.

Moreover, the platform's flexibility, designed to accommodate various user roles, ensures that all parties have access to critical information and tools, including contractual templates and flexible tariff models. This comprehensive approach fosters collaboration among stakeholders and enhances engagement with energy efficiency initiatives.

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