



# Overview on the HBR performance, HU-BES platform and SUPERHERO software

*30<sup>th</sup> September 2025*  
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*UNIVPM*

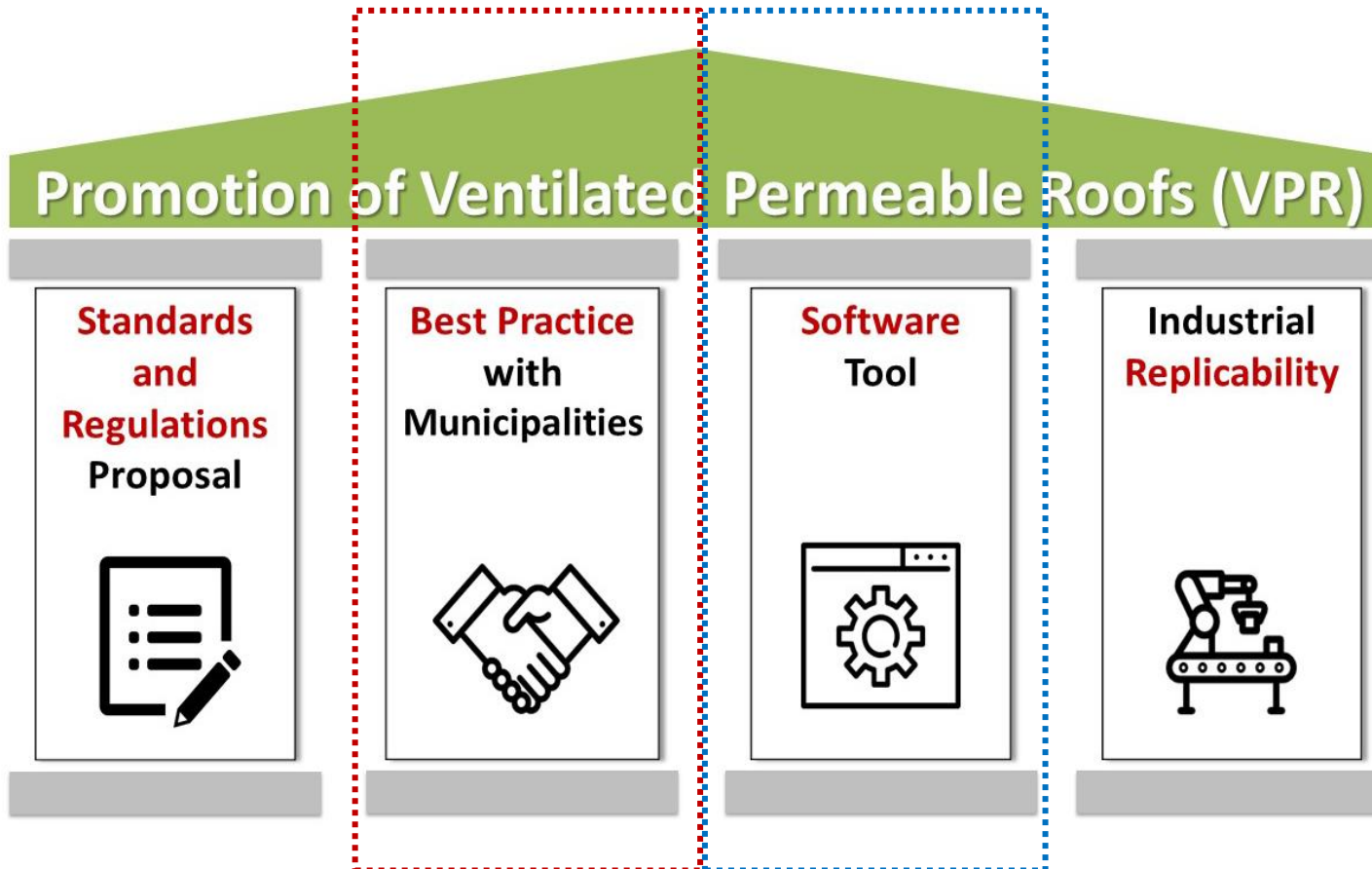


Con il contributo del Programma LIFE dell'Unione Europea  
LIFE 19 CCA/IT/001194

# The LIFE-SUPERHERO project

**Action C.2: Best-practice for realization of HEROTILE-Based Roof**

**Action C.3: Development of an open source and user-friendly SUPERHERO software**



1. Design and installation of HBR systems in demonstrator buildings to highlight their simplicity and cost-effectiveness
2. Monitoring of energy performance and indoor environmental quality before and after HBR installation
3. Development of the HU-BES platform for data sharing with both expert and non-expert users
4. Creation of the open-source SUPERHERO software to assess the environmental and economic benefits across the life cycle of VPR and HBR roofs

# Content of the presentation – Part 1

- 1. The renovation and monitoring plan of the demonstrator buildings**
- 2. The overall structure of monitoring system**
- 3. The HU-BES platform (HUMAN-BEHAVIORS monitoring data Sharing)**
  1. The subscription and access to HU-BES platform
  2. The demonstration of the user-interface
- 4. Preliminary HBR results**
  1. Thermal and energy performance of HBR
  2. Specific period comparison between HBR and Original roof
  3. Air Conditioning activation before and after retrofit with HBR

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# The renovation and monitoring plan

| 2022                                                                                         |                                                                                   |                                                                                    | 2023/2024                                                                           | 2025                                                                                 |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Original buildings with unventilated flat roofs (low thermal performance and comfort levels) |                                                                                   |                                                                                    | Renovation (external thermal insulation, windows, heating system)                   | Renovation with HBR                                                                  |
| # 1                                                                                          |   |   |   |  |
| # 2                                                                                          |  |  |  |  |
| Monitoring before renovation                                                                 |                                                                                   |                                                                                    | Monitoring after envelope renovation                                                | Monitoring after HBR installation                                                    |

# The renovation with HBR

Main structure and secondary structure with wooden trusses, beams and purlins



Wooden deck on the secondary wooden frame



Waterproof and breathable membrane



Substructure of battens for tiles (2 x 4cm)



Installation of tiles following producers' instructions for optimal ventilation



Installation of probes for the roof thermal performance monitoring



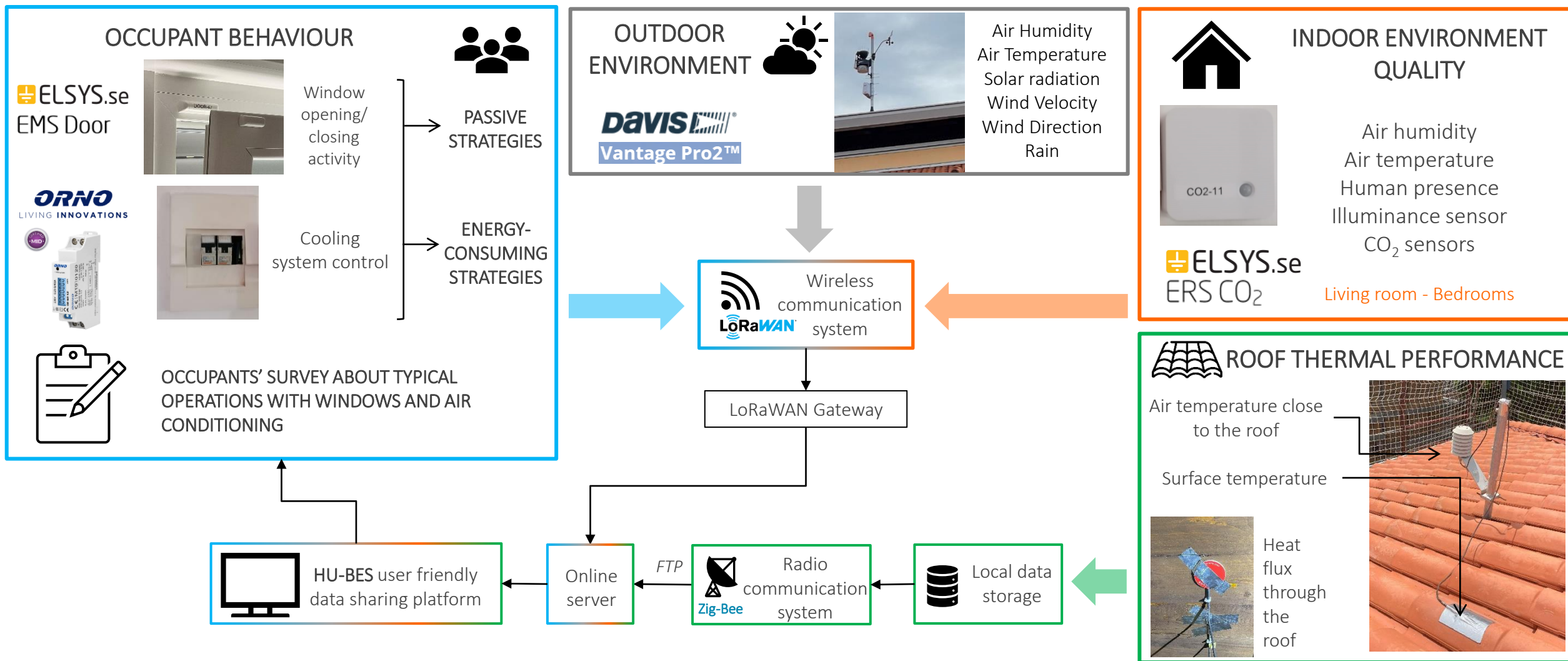
Final result on the building demonstrators



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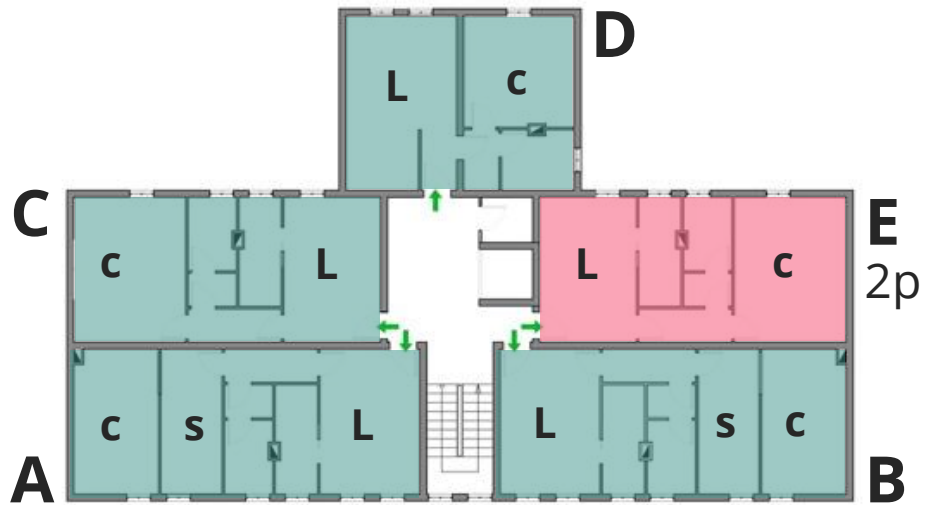
# The monitoring system



# The monitoring system

## Building #1

3° floor plan



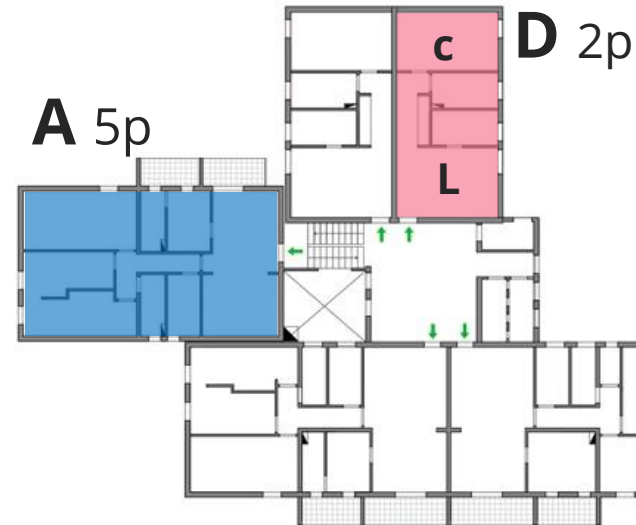
**24 monitored rooms**

**3 (+1) occupied apartments:** 6 people

**6 unoccupied apartments:** baseline for the assessment of apartments' thermal and energy performance

## Building #2

2° floor plan



3° floor plan

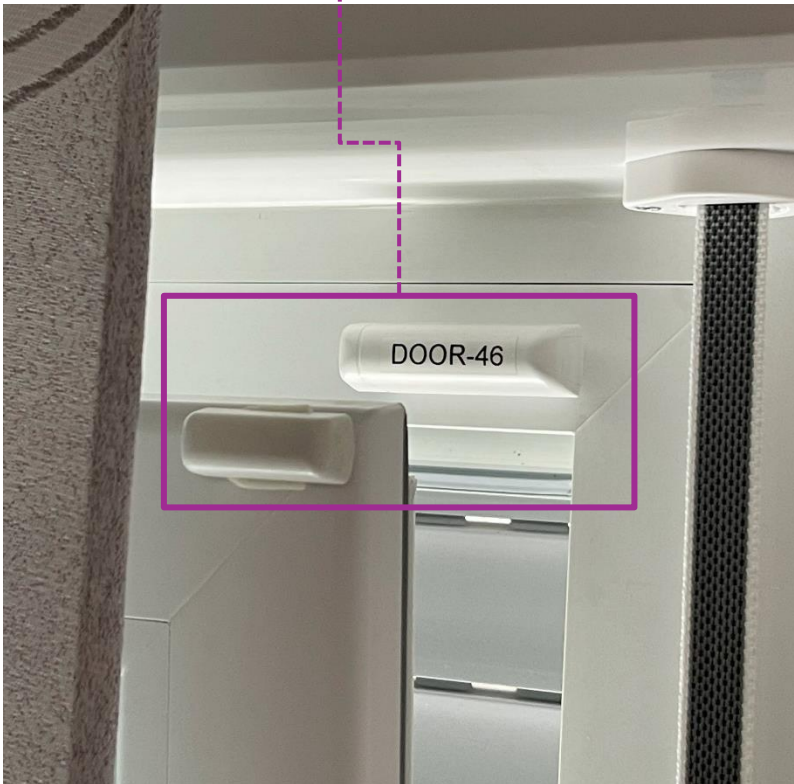


# The monitoring system

[2022-2023-2025]

The **indoor** monitoring system of IEQ and behaviour

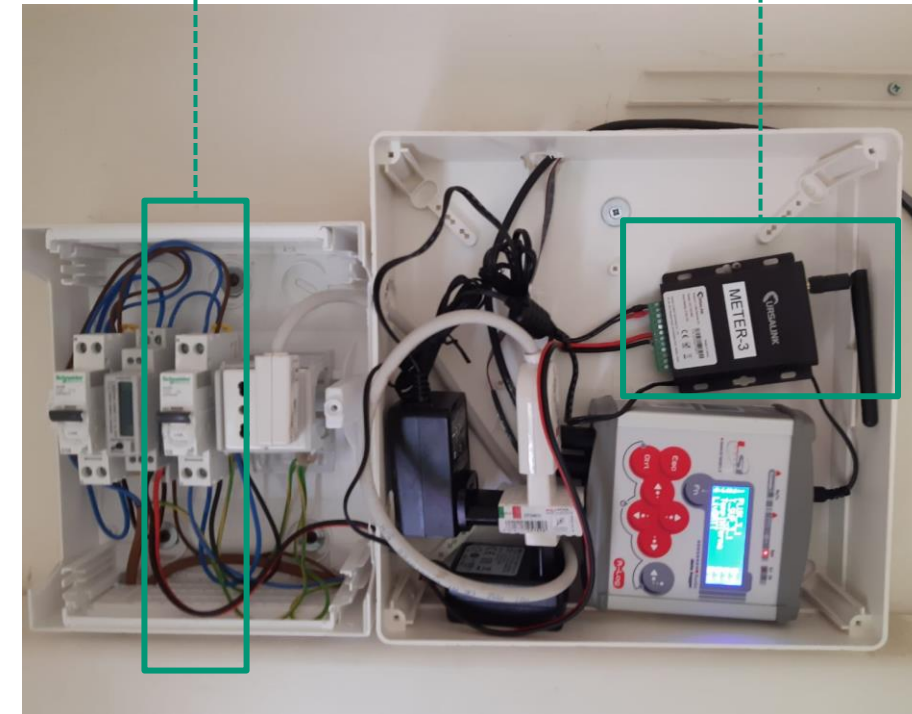
Opening activity sensor  
(window frames)



Indoor environment sensor  
(wall mounted)



AC energy meter



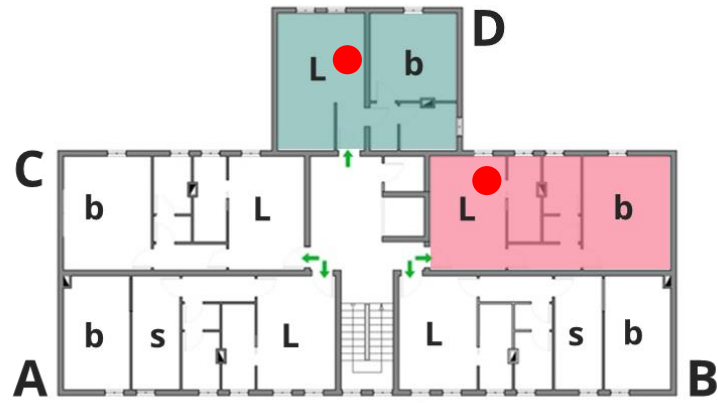
# The monitoring system

[2022-2023-2025]

The **indoor** monitoring system of the roof performance

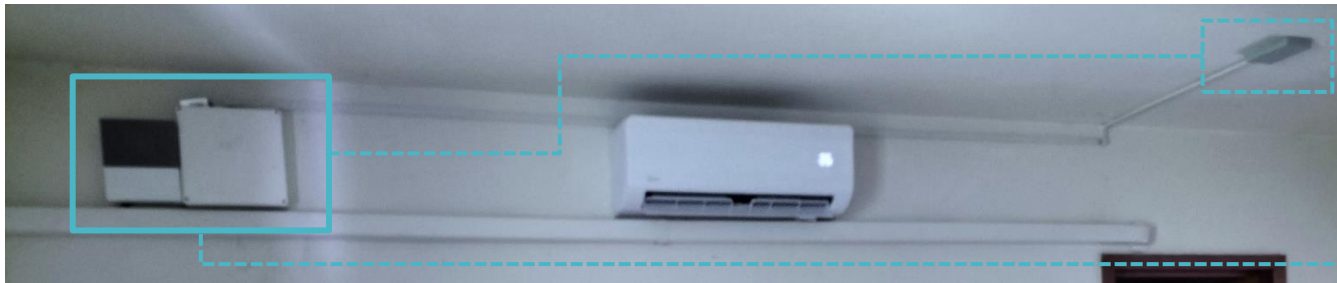
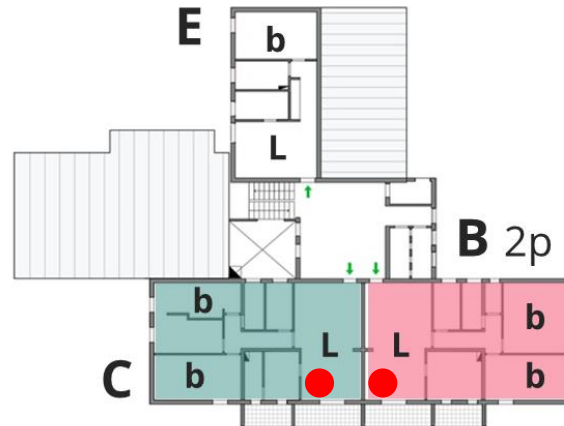
*Building #1*

*3° floor plan*



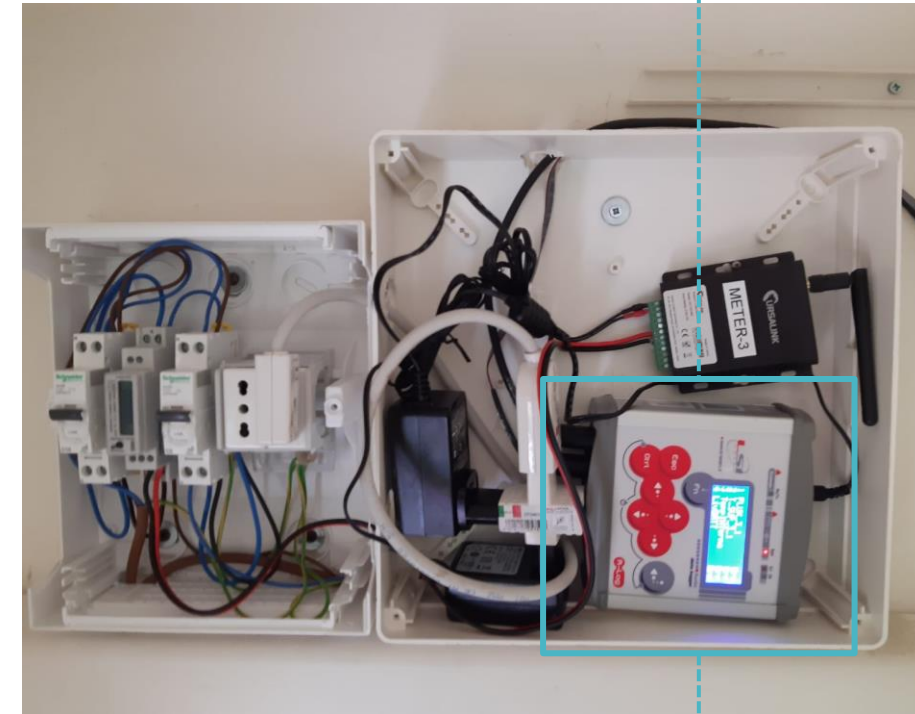
*Building #2*

*3° floor plan*



Roof  
monitoring  
probes

Data  
logger



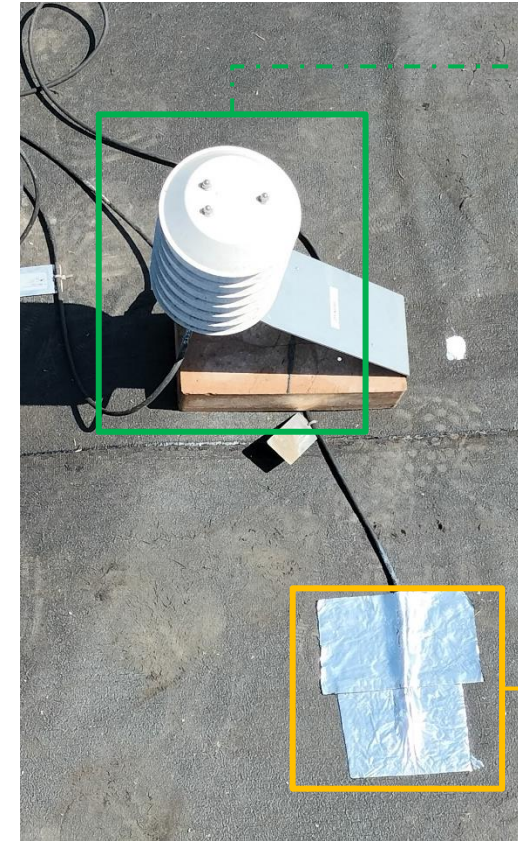
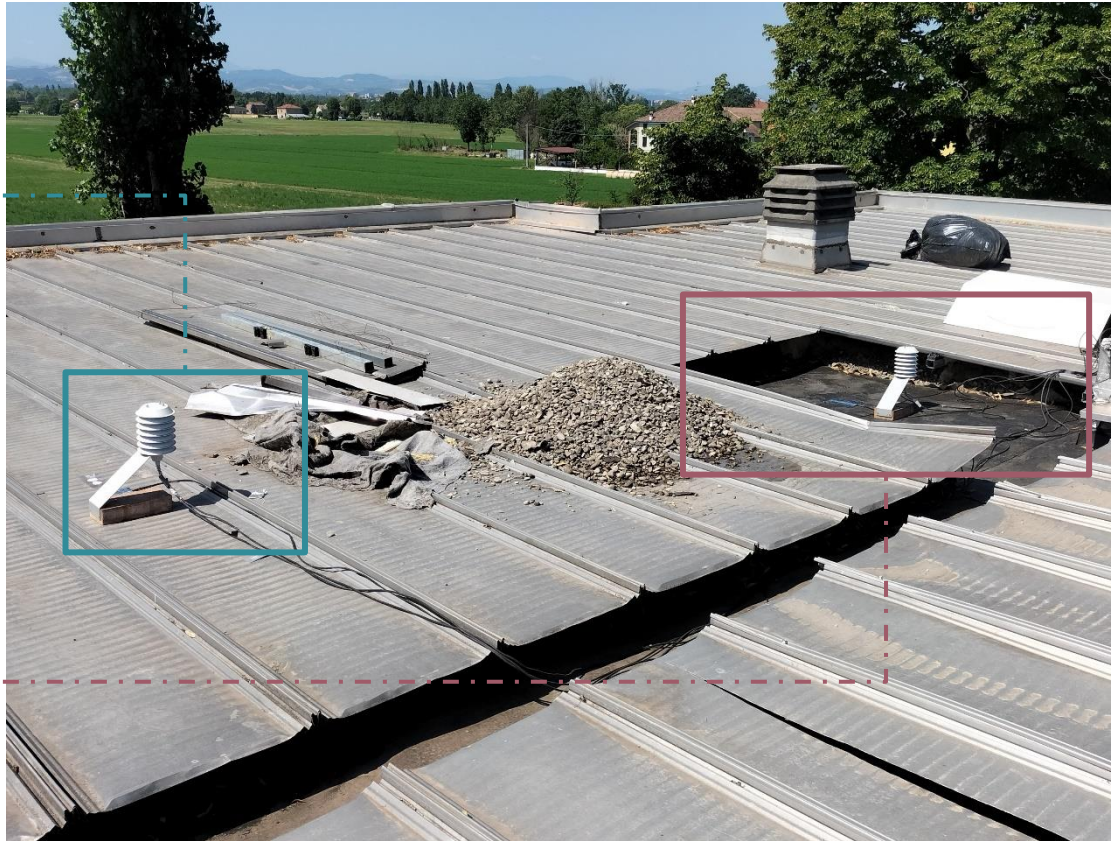
# The monitoring system

[2022-2023]

The **outdoor** monitoring system of the original roof

Roof with  
metal  
covering

Roof  
without  
metal  
covering



Air temperature  
close to the roof  
probe

Roof external  
surface  
temperature probe

# The monitoring system

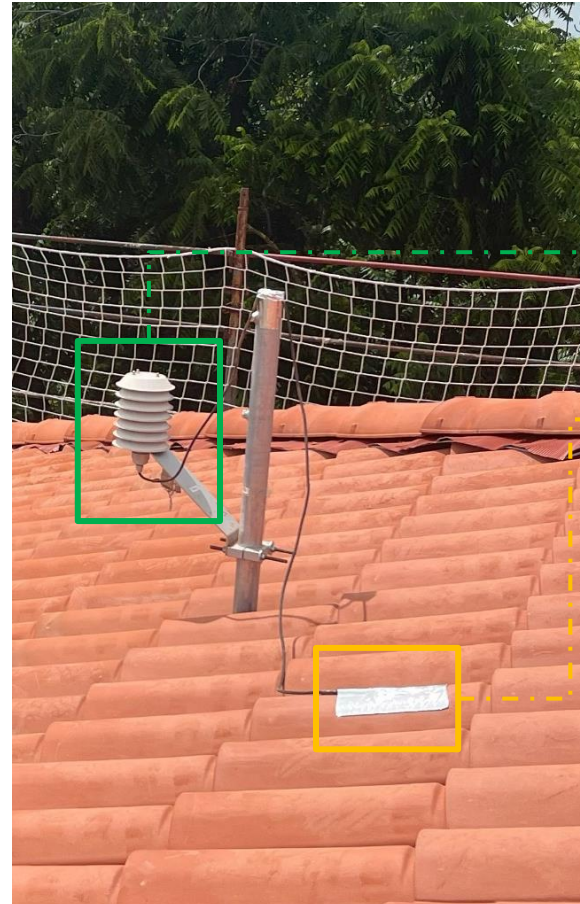
[2025]

The **outdoor** monitoring system of the two HBR slopes

North  
slope



South  
slope



Air temperature close  
to the roof probe

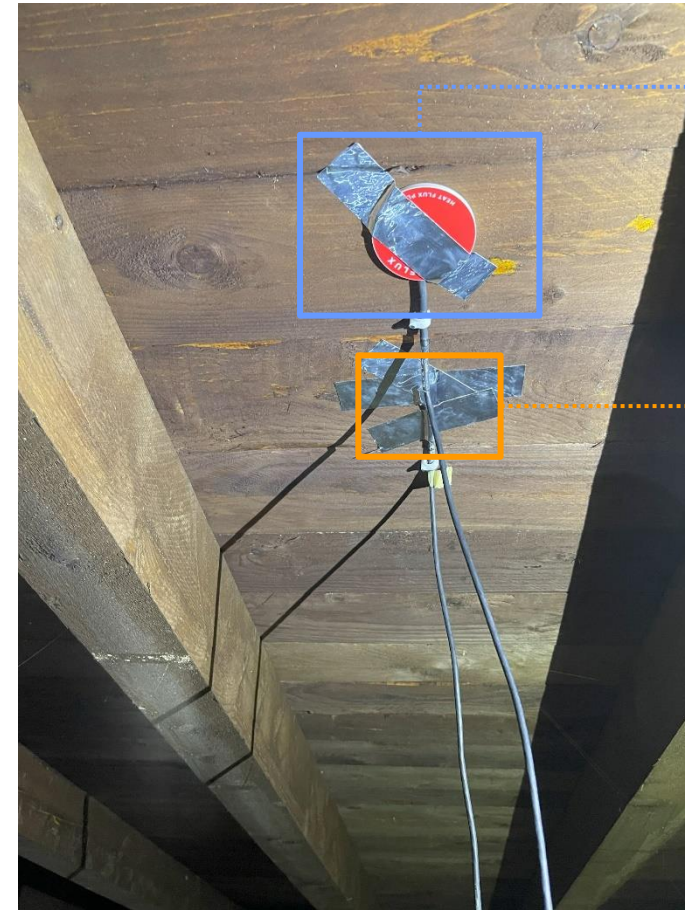
Roof external  
surface  
temperature probe



# The monitoring system

[2025]

The new HBR attic floor and the indoor monitoring probes



Heat flux through  
the roof probe

Roof deck surface  
temperature probe

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- 3. The HU-BES platform (HUMAN-BEHAVIORS monitoring data Sharing)**
  1. The subscription and access to HU-BES platform
  2. The demonstration of the user-interface
- 4. Preliminary HBR results**
  1. Thermal and energy performance of HBR
  2. Specific period comparison between HBR and Original roof
  3. Air Conditioning activation before and after retrofit with HBR

# The HU-BES platform

## **HU-BES (HUMAN-BEHAVIORS monitoring data SHARING) Platform**

- ✓ An interactive web-based platform
- ✓ Sharing monitored data on indoor environmental quality and roof performance of LIFE SUPERHERO demonstrator buildings
- ✓ Visualisation of benefits after renovation with the HBR solution



HU-BES DATA SHARING PLATFORM

# The HU-BES platform

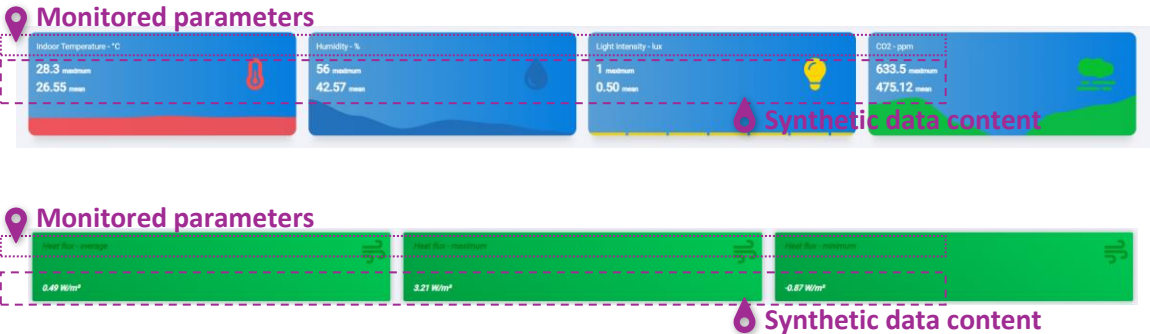
## HU-BES (HUMAN-BEHAVIORS monitoring data SHaring) Platform

✓ User-friendly and quantitative data representation to non-expert and expert end-users

### NON-EXPERT END-USERS

General public - Stakeholders - External users - Building owner/tenants

Synthetic icon-based data (i.e., average, maximum and minimum values)

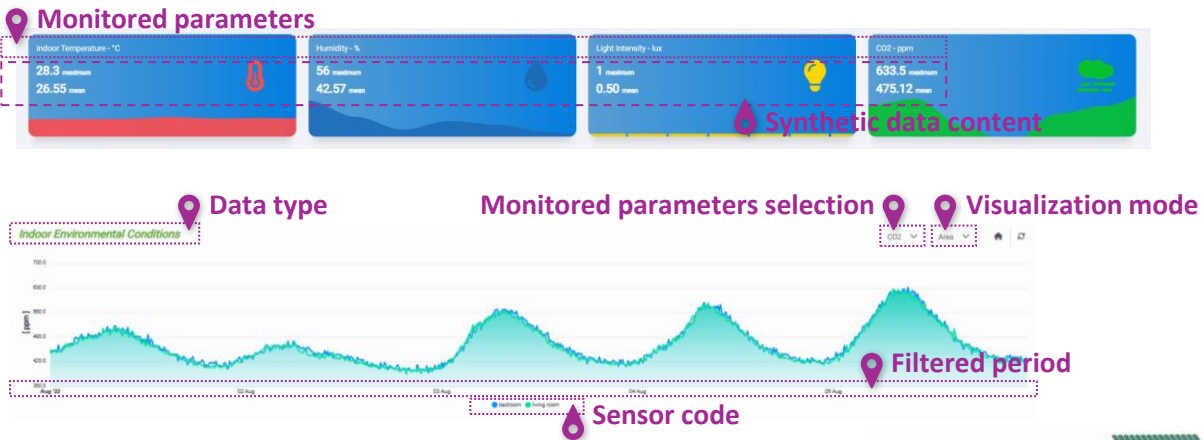


### EXPERT END-USERS

Professional (Engineer, Architect) - Facility Manager - Policymaker  
Company - Researcher - LIFESUPERHERO Partner

Synthetic icon-based data (i.e., average, maximum and minimum values)

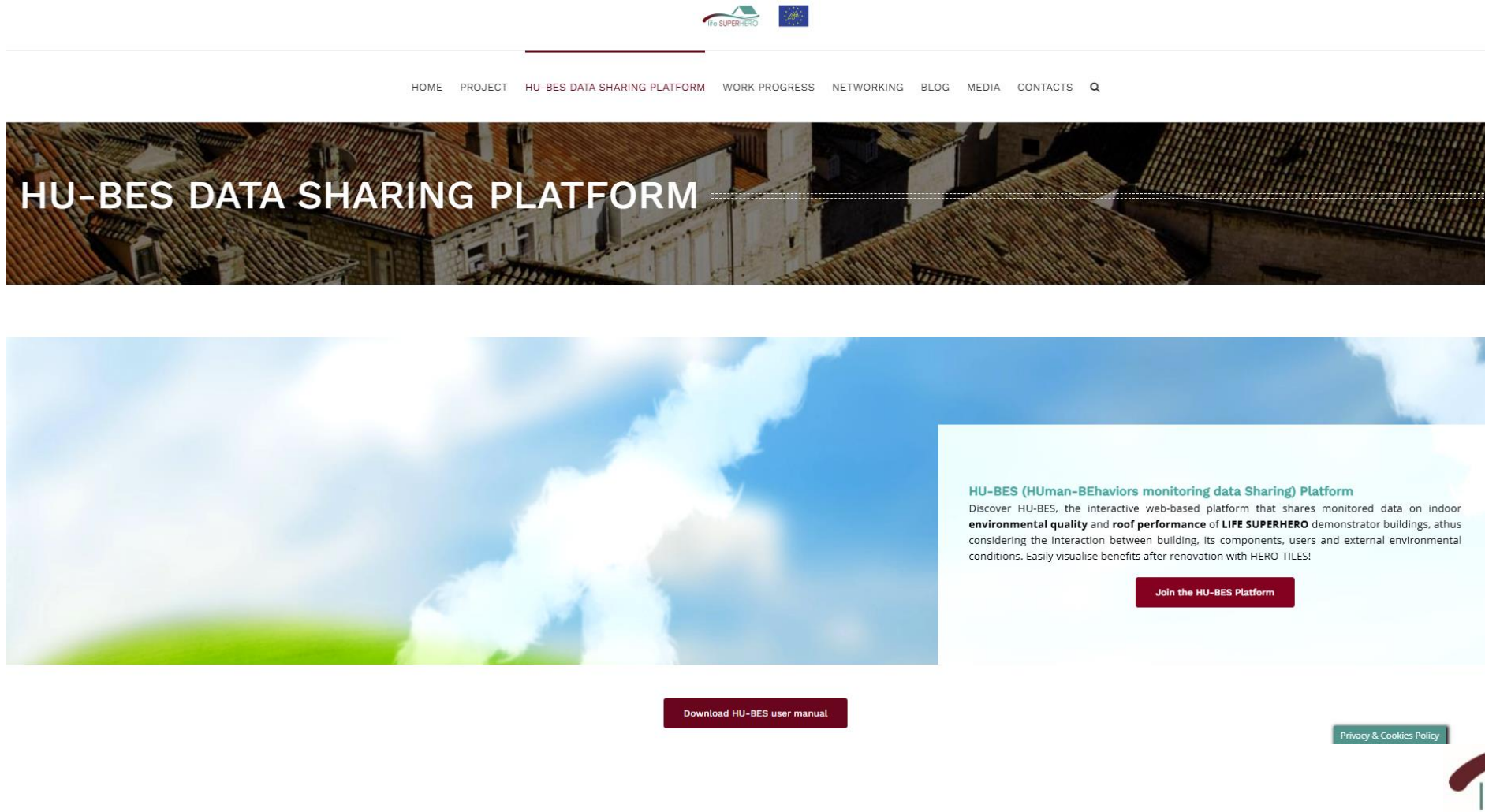
Interactive trend charts offer detailed time series visualizations



# The HU-BES platform

## 1. Subscription and access to the HU-BES platform

- Access to LIFESUPERHERO Website <https://www.lifesuperhero.eu/hu-bes-data-sharing-platform/>



The screenshot displays the HU-BES Data Sharing Platform website. At the top, there is a navigation bar with links: HOME, PROJECT, HU-BES DATA SHARING PLATFORM (highlighted), WORK PROGRESS, NETWORKING, BLOG, MEDIA, and CONTACTS. Below the navigation bar is a large banner image showing a close-up of terracotta roof tiles. Overlaid on this banner is the text "HU-BES DATA SHARING PLATFORM" in white, bold, uppercase letters. Below the banner is a large image of a bright blue sky with white clouds. On the right side of this image, there is a white box containing the following text: "HU-BES (HUMAN-BEHAVIORS monitoring data SHARING) Platform" in bold, followed by a paragraph: "Discover HU-BES, the interactive web-based platform that shares monitored data on indoor **environmental quality** and **roof performance** of LIFE SUPERHERO demonstrator buildings, thus considering the interaction between building, its components, users and external environmental conditions. Easily visualise benefits after renovation with HERO-TILES!". Below this text is a red button with the text "Join the HU-BES Platform". At the bottom of the page, there is a red button with the text "Download HU-BES user manual" and a green button with the text "Privacy & Cookies Policy". In the bottom right corner, there is a logo for "life SUPERHERO" featuring a stylized green roof icon.

life SUPERHERO

# The HU-BES platform

## 1. Subscription and access to the HU-BES platform

- Complete the registration form to get the login credential

The image shows a screenshot of the HU-BES platform website. The main header features the 'life SUPERHERO' logo and a navigation menu with links: HOME, PROJECT, HU-BES DATA SHARING PLATFORM, WORK PROGRESS, NETWORKING, BLOG, MEDIA, and CONTACTS. A large banner image of a historic building with a tiled roof displays the text 'HU-BES DATA SHARING PLATFORM'. Below this, a section with a blue sky background contains a text box describing the platform: 'HU-BES (HUMAN-BEHAVIORS monitoring data SHARING) Platform' and 'Discover HU-BES, the interactive web-based platform that shares monitored data on indoor environmental quality and roof performance of LIFE SUPERHERO demonstrator buildings...'. A red arrow points from this text box to a 'Join the HU-BES Platform' button. A red dashed line connects this button to a registration form overlay on the right. The form, titled 'Registration form', includes the 'life SUPERHERO' logo, the text 'Register to HU-BES Platform to get access', and a green button labeled 'Inizia ora'. At the bottom of the page, there are links for 'Download HU-BES user manual' and 'Privacy & Cookies Policy', and the 'life SUPERHERO' logo is repeated in the footer.

life SUPERHERO

HOME PROJECT HU-BES DATA SHARING PLATFORM WORK PROGRESS NETWORKING BLOG MEDIA CONTACTS

### HU-BES DATA SHARING PLATFORM

HU-BES (HUMAN-BEHAVIORS monitoring data SHARING) Platform

Discover HU-BES, the interactive web-based platform that shares monitored data on indoor **environmental quality** and **roof performance** of LIFE SUPERHERO demonstrator buildings, thus considering the interaction between building, its components, users and external environmental conditions. Easily visualise benefits after renovation with HERO-TILES!

Join the HU-BES Platform

Download HU-BES user manual

Privacy & Cookies Policy

life SUPERHERO

### Registration form

Register to HU-BES Platform to get access

Inizia ora

# The HU-BES platform

## 1. Subscription and access to the HU-BES platform

- Download user manual (ITA – ENG)

The screenshot shows the HU-BES platform website. At the top, there is a navigation bar with links: HOME, PROJECT, HU-BES DATA SHARING PLATFORM, WORK PROGRESS, NETWORKING, BLOG, MEDIA, and CONTACTS. Below the navigation bar is a large banner with the text "HU-BES DATA SHARING PLATFORM" over a background image of a historic building with a tiled roof. To the right of the banner, there is a white box containing the "life SUPERHERO" logo, the text "HU-BES Platform - User Manual", and a description: "Sharing monitored data on indoor environmental quality and roof performance from the LIFE SUPERHERO project". Below this box is a red dashed arrow pointing to the "Download HU-BES user manual" button. At the bottom of the page, there is a large blue and green banner with the text "HU-BES (HUMAN-BEHAVIORS monitoring data SHARING) Platform" and a description: "Discover HU-BES, the interactive web-based platform that shares monitored data on indoor environmental quality and roof performance of LIFE SUPERHERO demonstrator buildings, thus considering the interaction between building, its components, users and external environmental conditions. Easily visualise benefits after renovation with HERO-TILES!". Below this banner is a red arrow pointing to the "Download HU-BES user manual" button. At the bottom right, there is a "Privacy & Cookies Policy" link and the "life SUPERHERO" logo.

life SUPERHERO

HU-BES Platform - User Manual

Sharing monitored data on indoor environmental quality and roof performance from the LIFE SUPERHERO project

LIFE SUPERHERO LIFE19 CCA/IT/001194

HOME PROJECT HU-BES DATA SHARING PLATFORM WORK PROGRESS NETWORKING BLOG MEDIA CONTACTS

HU-BES DATA SHARING PLATFORM

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Join the HU-BES Platform

Download HU-BES user manual

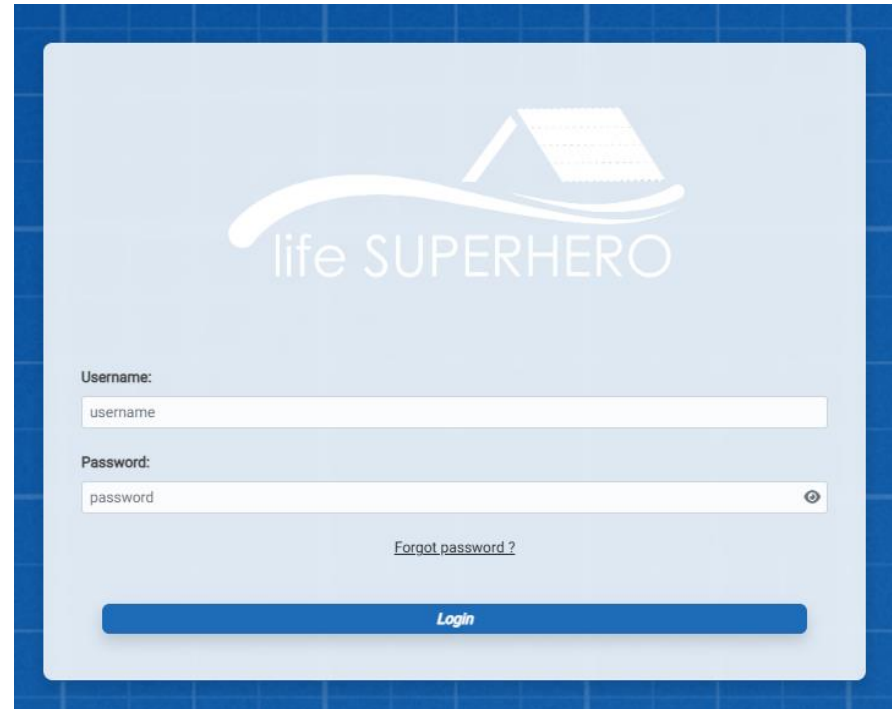
Privacy & Cookies Policy

life SUPERHERO

# The HU-BES platform

## 1. Subscription and access to the HU-BES platform

- Access to HU-BES platform <https://193.206.120.248/#/login> using a browser (no installation needed)



The screenshot shows a login interface for the 'life SUPERHERO' platform. At the top, there is a logo consisting of a stylized house icon above the text 'life SUPERHERO'. Below the logo, there are two input fields: 'Username:' with a placeholder 'username' and 'Password:' with a placeholder 'password'. A small eye icon is visible next to the password field. Below the password field, there is a link that says 'Forgot password?'. At the bottom, there is a blue button labeled 'Login'.

# The HU-BES platform

## 2. The demonstration of the user-interface

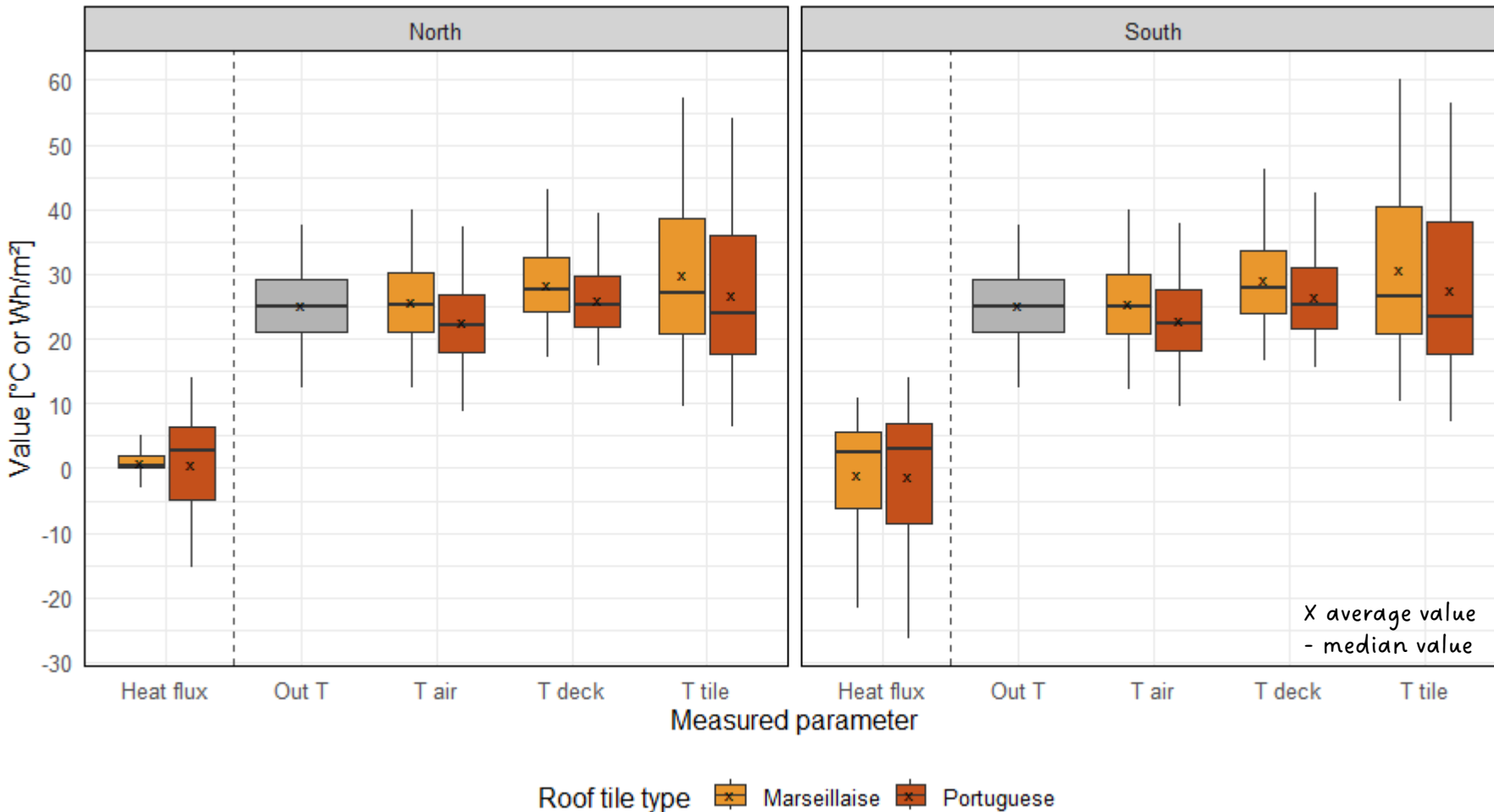
<https://193.206.120.248/#/login>

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# Preliminary HBR results

Thermal and energy performance of HEROTiles – by slope orientation

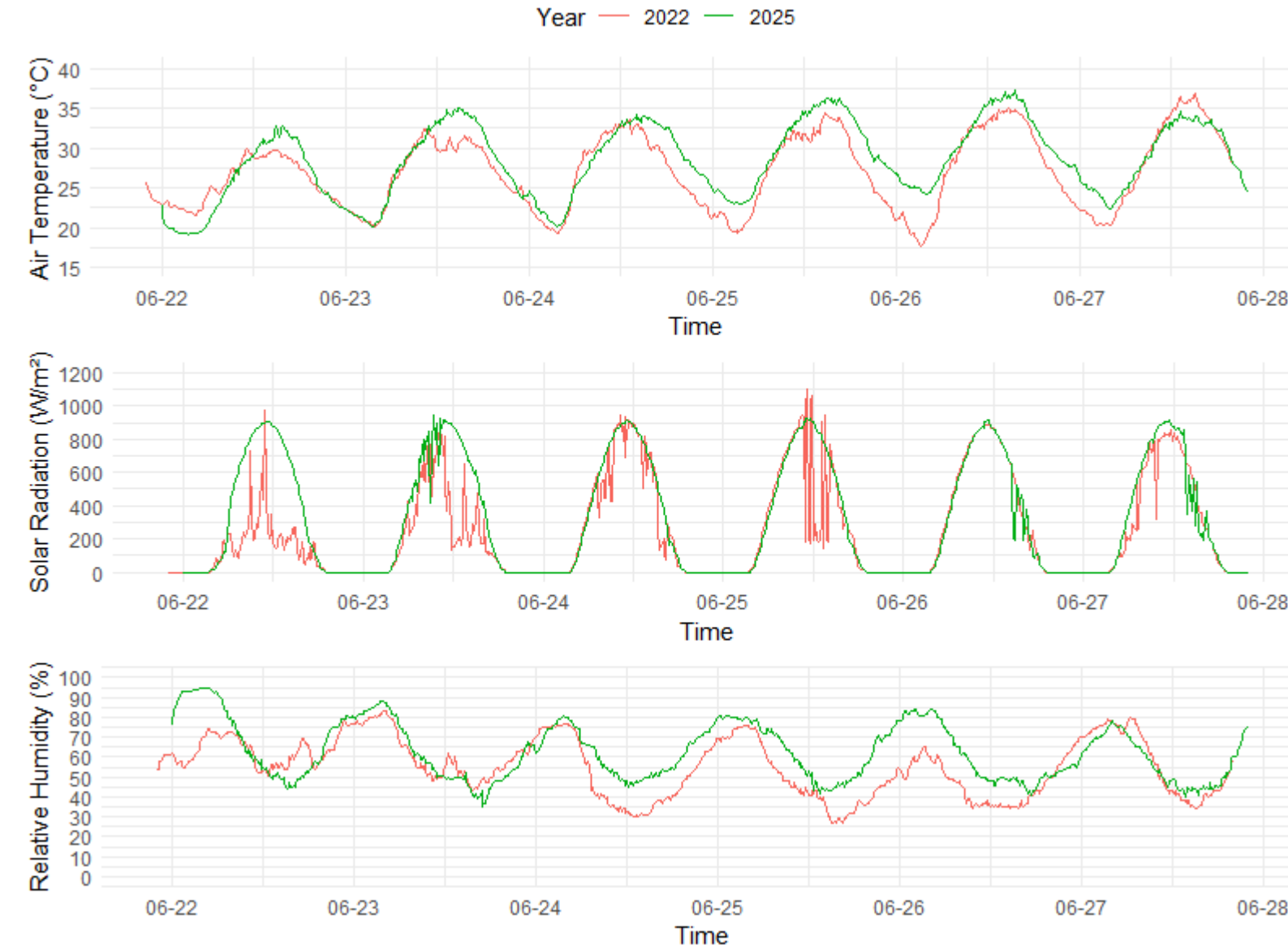


| Building                | Parameter        | Slope | Maximum values |
|-------------------------|------------------|-------|----------------|
| #1 (23)<br>Portuguese   | Deck Temperature | North | 35.42          |
|                         | Deck Temperature | South | 38.30          |
|                         | Air Temperature  | North | 32.47          |
|                         | Air Temperature  | South | 33.33          |
|                         | Tile temperature | North | 45.96          |
|                         | Tile temperature | South | 50.35          |
| #2 (25)<br>Marseillaise | Deck Temperature | North | 39.04          |
|                         | Deck Temperature | South | 41.77          |
|                         | Air Temperature  | North | 35.66          |
|                         | Air Temperature  | South | 35.79          |
|                         | Tile temperature | North | 49.10          |
|                         | Tile temperature | South | 53.87          |

→ most extreme values were recorded on the south slope

# Preliminary HBR results - Comparison

Specific period selection for the comparison between HBR and Original Roof

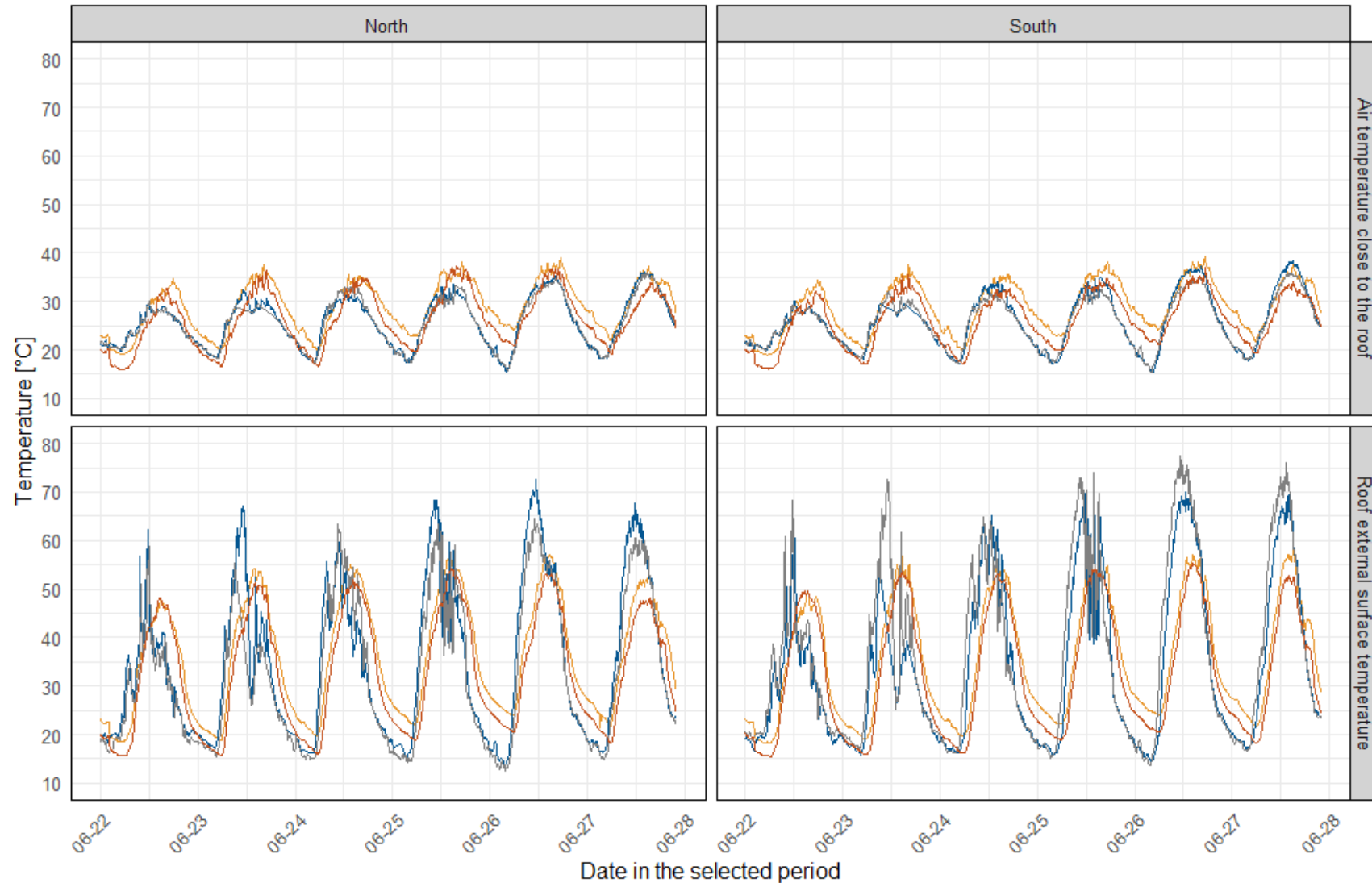


| Year | Day   | Maximum Out_Temp | Maximum Sol_Rad | Maximum Rel_Hum |
|------|-------|------------------|-----------------|-----------------|
| 2022 | 22/06 | 30.00            | 979             | 79              |
|      | 23/06 | 32.39            | 838             | 83              |
|      | 24/06 | 33.61            | 944             | 77              |
|      | 25/06 | 34.33            | 1107            | 76              |
|      | 26/06 | 35.00            | 896             | 70              |
|      | 27/06 | 36.78            | 861             | 80              |
| 2025 | 22/06 | 32.78            | 902             | 95              |
|      | 23/06 | 35.00            | 947             | 88              |
|      | 24/06 | 34.28            | 912             | 81              |
|      | 25/06 | 36.33            | 928             | 81              |
|      | 26/06 | 37.22            | 919             | 84              |
|      | 27/06 | 34.56            | 914             | 78              |

Generally comparable periods with slightly higher Outdoor Air Temperature values in 2025

# Preliminary HBR results - Comparison

Thermal and energy performance comparison between HBR and Original Roof in the selected period

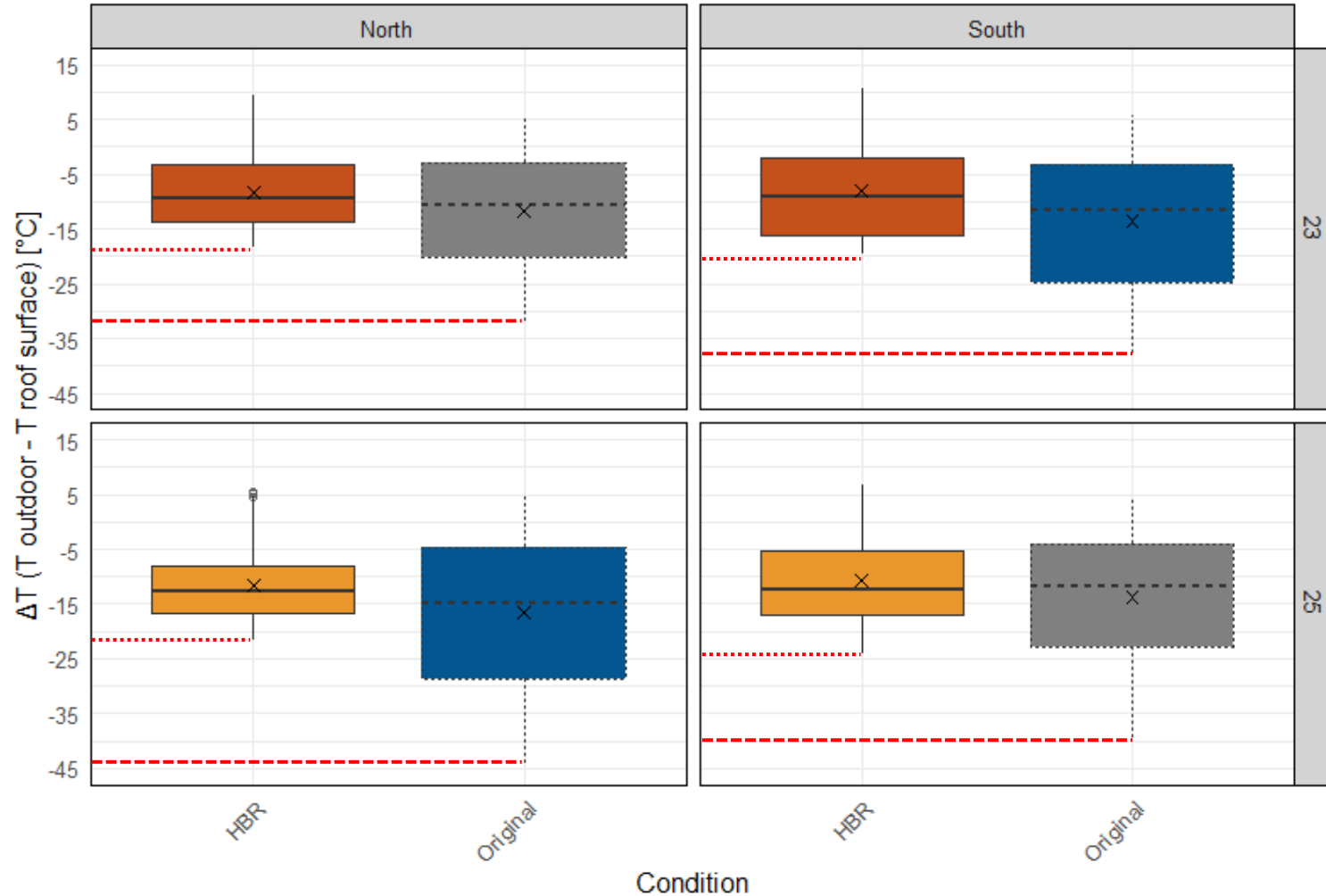


| Roof Type                   | Parameter           | Slope | Maximum values |
|-----------------------------|---------------------|-------|----------------|
| #1 (23) Membrane (Original) | Air Temperature     | South | 38.50          |
|                             | Surface temperature | South | 69.90          |
| #2 (25) Membrane (Original) | Air Temperature     | North | 36.10          |
|                             | Surface temperature | North | 77.60          |
| #1 (23) Metal (Original)    | Air Temperature     | North | 35.90          |
|                             | Surface temperature | North | 64.40          |
| #2 (25) Metal (Original)    | Air temperature     | South | 35.90          |
|                             | Surface temperature | South | 72.70          |
| #1 (23) Portuguese (HBR)    | Air Temperature     | North | 36.96          |
|                             | Air Temperature     | South | 37.21          |
|                             | Surface temperature | South | 55.27          |
| #2 (25) Marseillaise (HBR)  | Air Temperature     | North | 39.07          |
|                             | Air Temperature     | South | 39.33          |
|                             | Surface temperature | South | 58.06          |

Roof type — Marseillaise (HBR) — Membrane (Original) — Metal (Original) — Portuguese (HBR)

# Preliminary HBR results - Comparison

Thermal and energy performance comparison between HBR and Original Roof in the selected period



$$\Delta T (T_{\text{Outdoor air}} - T_{\text{Roof surface}})$$

The much negative  $\Delta T$ , the higher  $T_{\text{Roof surface}}$

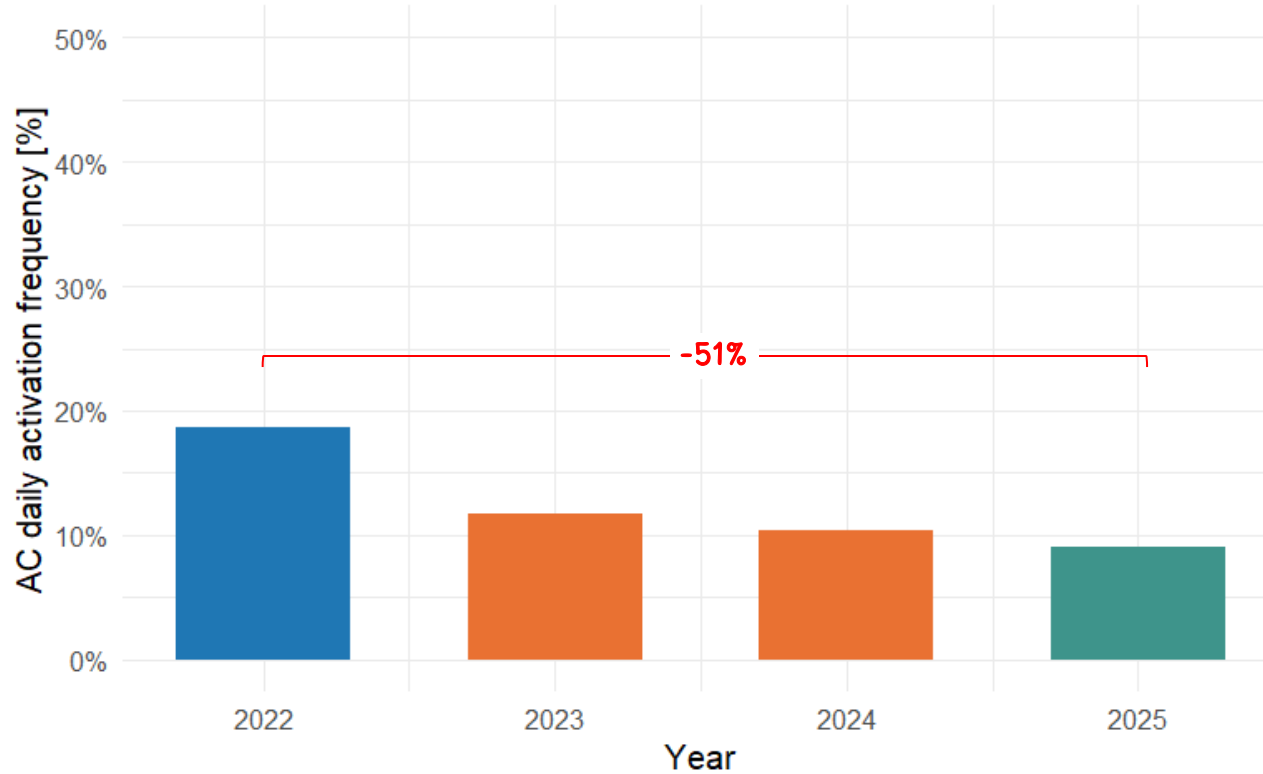
→ HBR reduces roof surface overheating, lowering maximum  $\Delta T$  from -32/-45 °C (original roof) to about -19/-23 °C

→ consistent effect in both orientation and building

Roof type Marseillaise Membrane Metal Portuguese Renovation status HBR Original

# Preliminary HBR results – Occupants behaviour

Air Conditioning use before and after retrofit with HBR



**Occupants' behaviour is extremely dynamic, highly variable and dependent from**

- Outdoor and indoor climate
- Occupancy and internal loads
- Personal habits and routines
- Comfort expectations
- Social norms

- Original roof
- Renovated envelope
- Renovation with HBR

An aerial photograph of a historic city, likely Dubrovnik, showing a dense cluster of buildings with red-tiled roofs. A church spire is visible in the upper center. The image is partially obscured by a dark blue diagonal overlay on the left side.

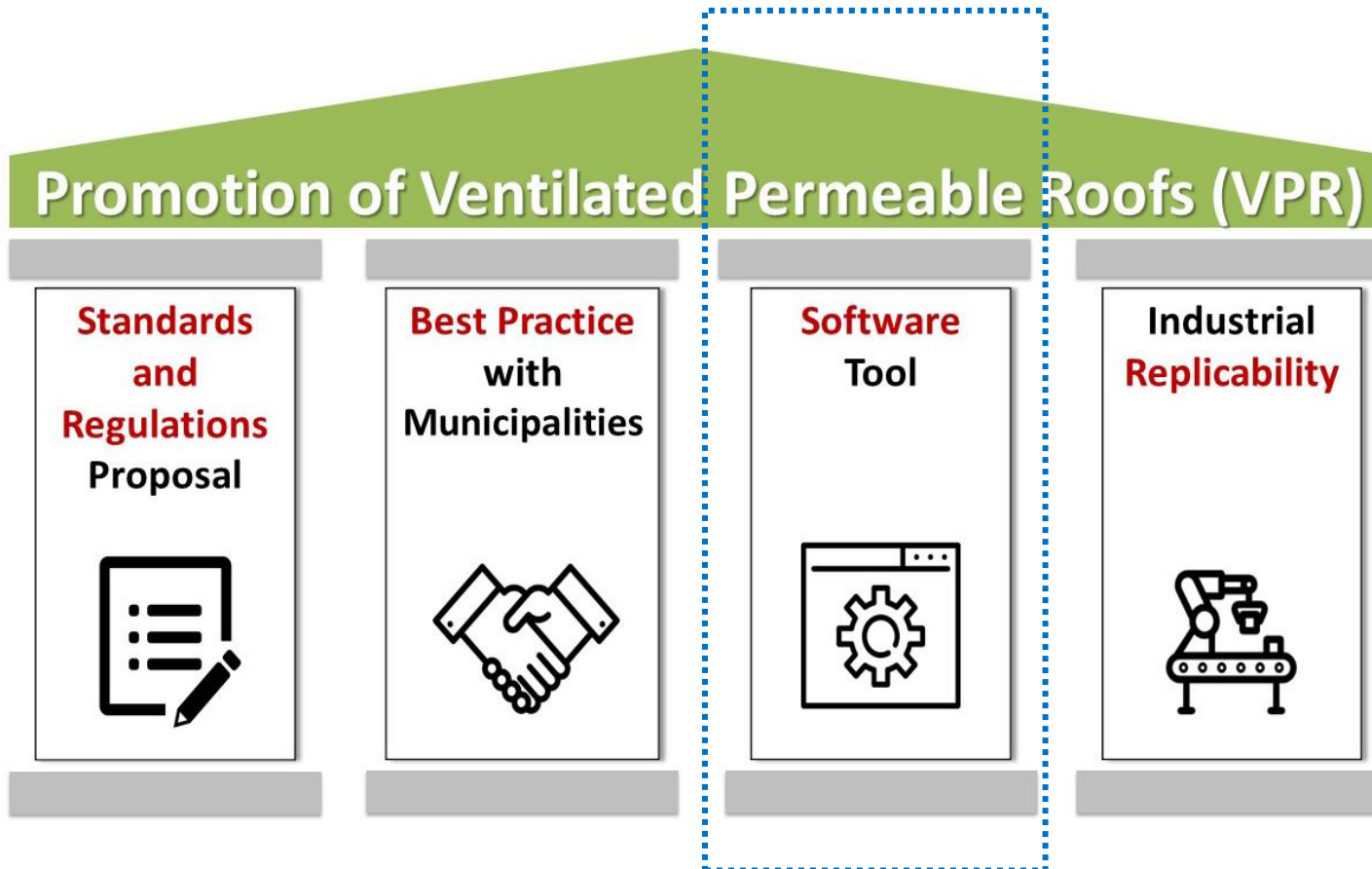
*Part 2*  
**The SUPERHERO software**



# The LIFE-SUPERHERO software

## in the LIFE-SUPERHERO project

*Action C.3: Development of an open source and user-friendly SUPERHERO software*



Creation of the open-source SUPERHERO software to assess the environmental and economic benefits across the life cycle of VPR and HBR roofs

# Why?

- ✓ To provide an assessment of the **environmental and economic benefits** over the life cycle of VPR/HBR roofs, in line with recent national and EU policies;
- ✓ Current building energy simulation tools do not account for the **cooling effect** of VPR/HBR roofs, which derives from the ventilation/permeability of the covering layer.



## Target users

- ✓ **Building sector stakeholders, consultants, and designers** interested in assessing the performance of different roof types in order to select the most suitable design solution;
- ✓ **Public authorities**, to evaluate the environmental and economic benefits of VPR/HBR as a best practice within their climate plans

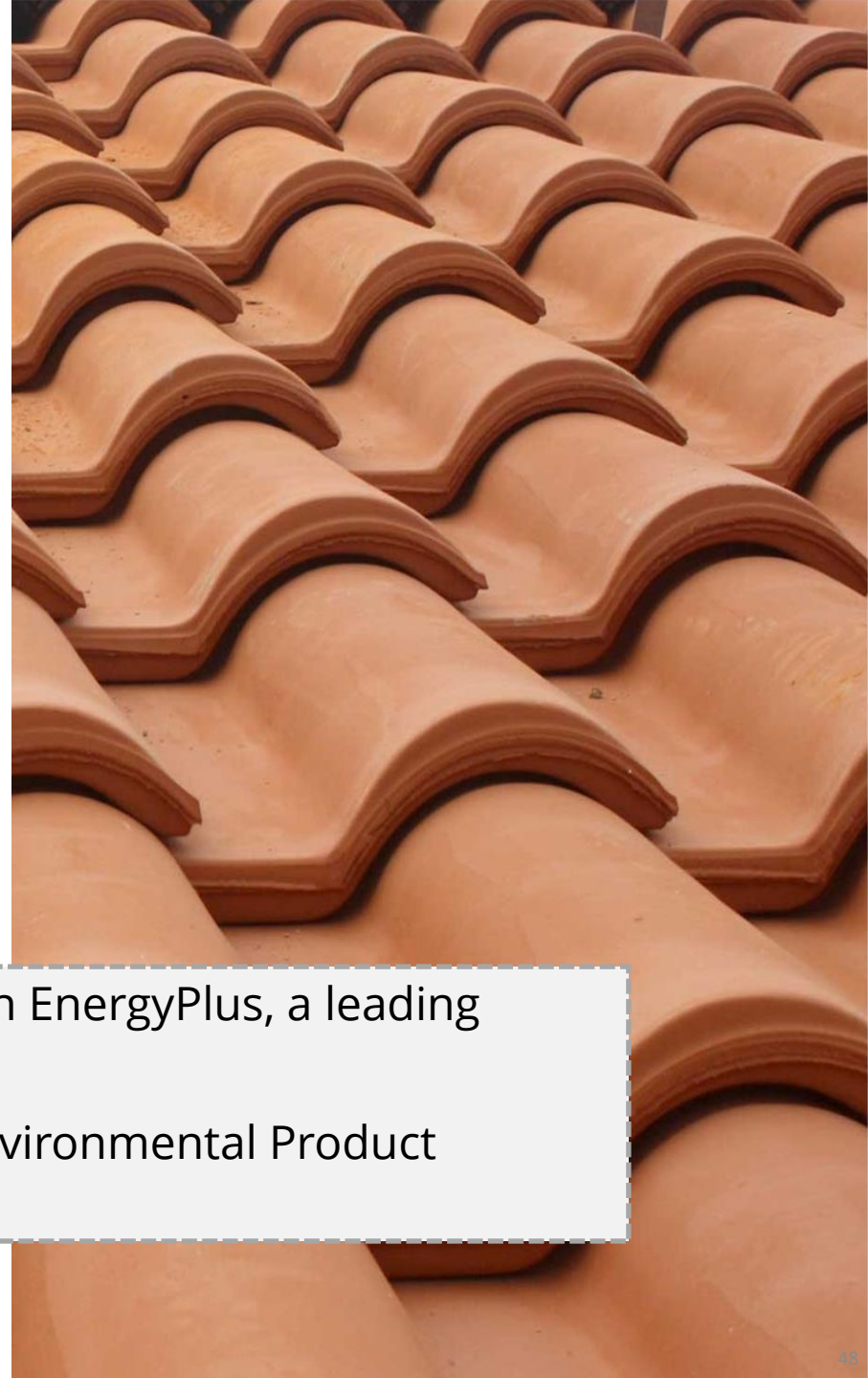


# What

The SUPERHERO software evaluates the performance of roofs, including VPR/HBR, in terms of:

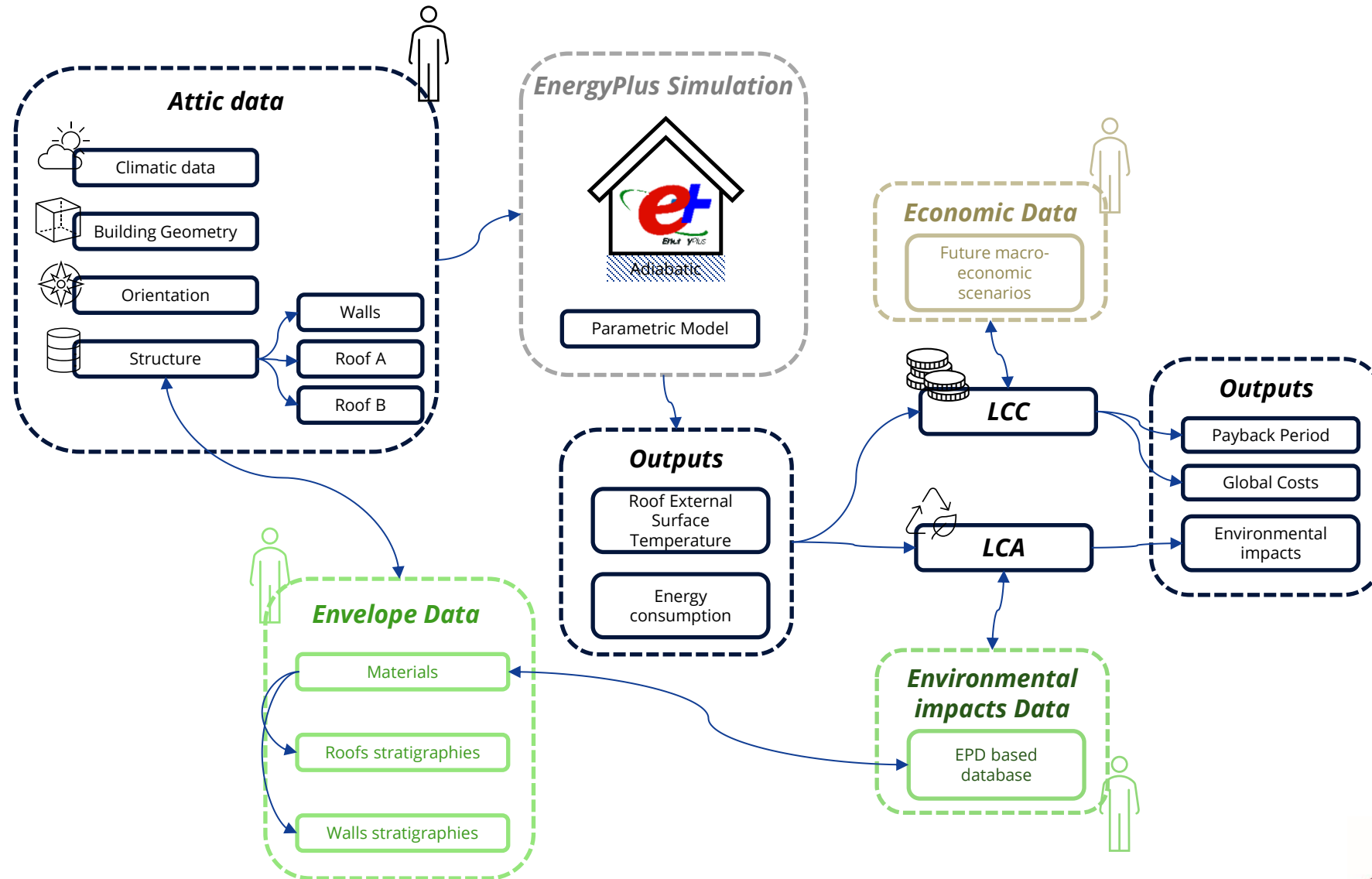
- ✓ **Energy consumption for cooling and heating** 
- ✓ **External surface temperature of the roof covering** 
- ✓ **Economic indicators** 
- ✓ **Environmental impact indicators** 

- The energy simulations are carried out using a parametric model in EnergyPlus, a leading international tool for dynamic building energy calculations.
- The software can directly read environmental data contained in Environmental Product Declarations (EPDs) in .xml format.



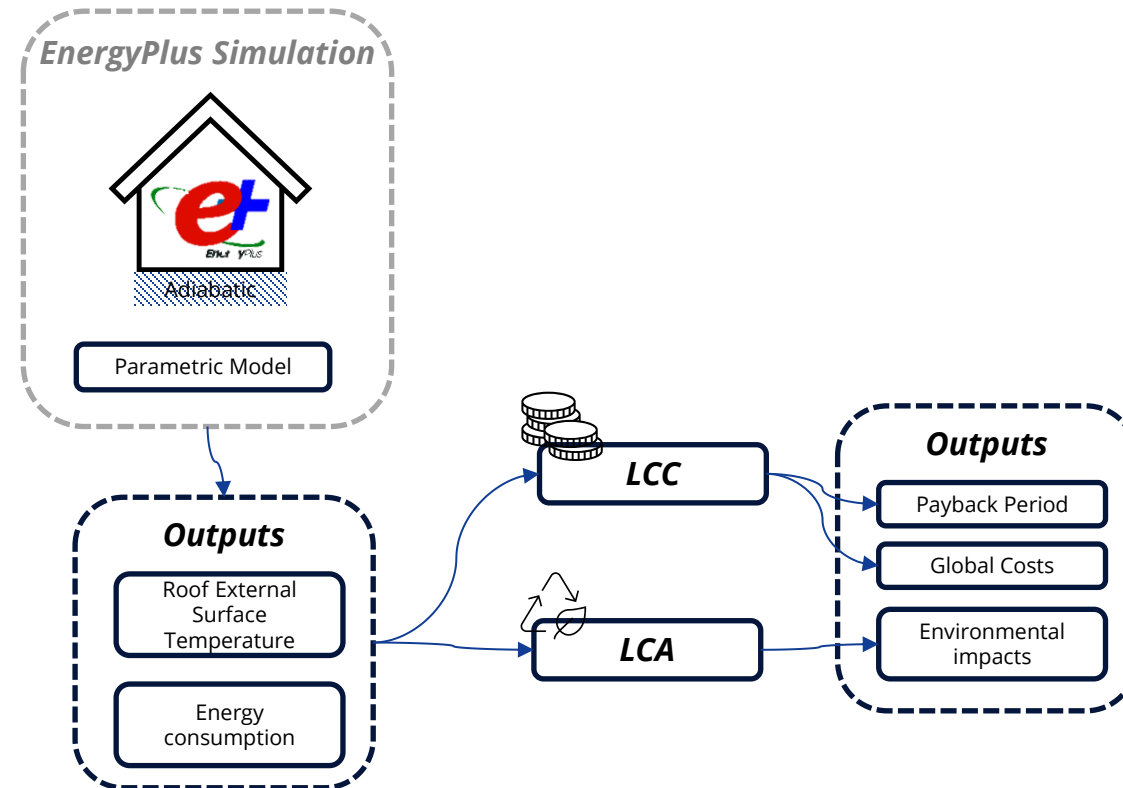
# How

## *SUPERHERO software architecture and workflow*



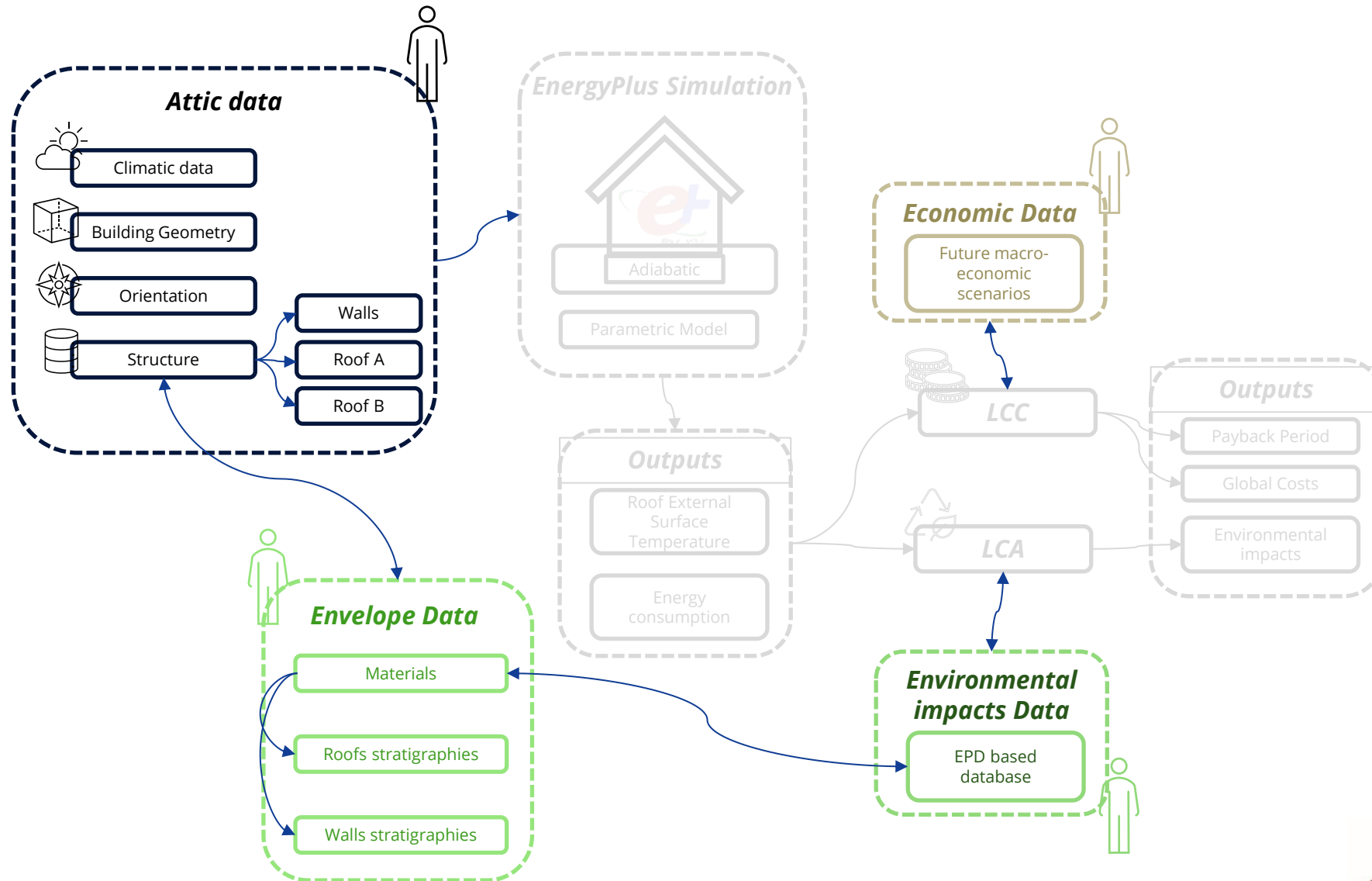
# How

## *SUPERHERO software architecture and workflow*



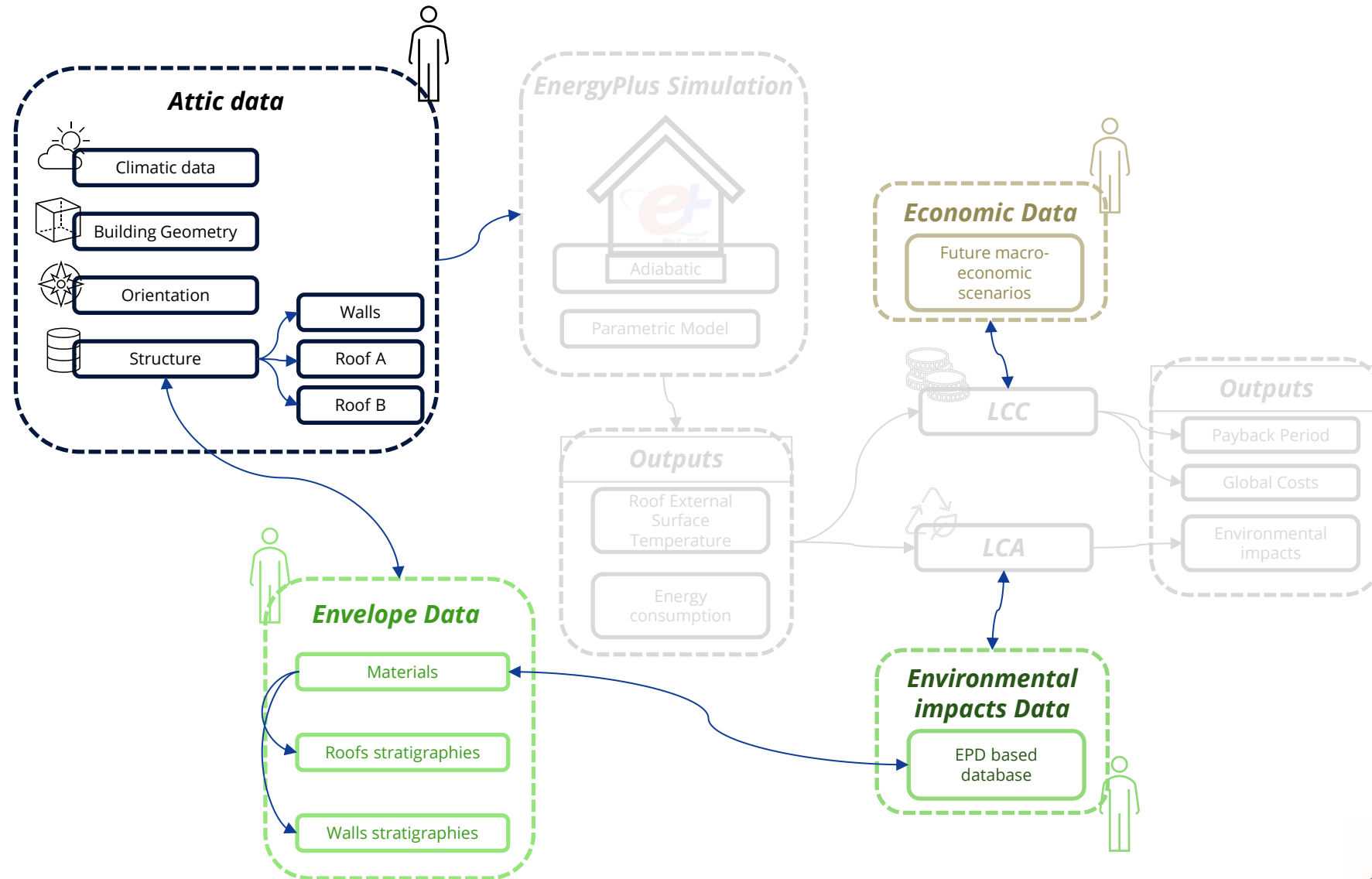
# How

## *SUPERHERO software architecture and workflow*



# How

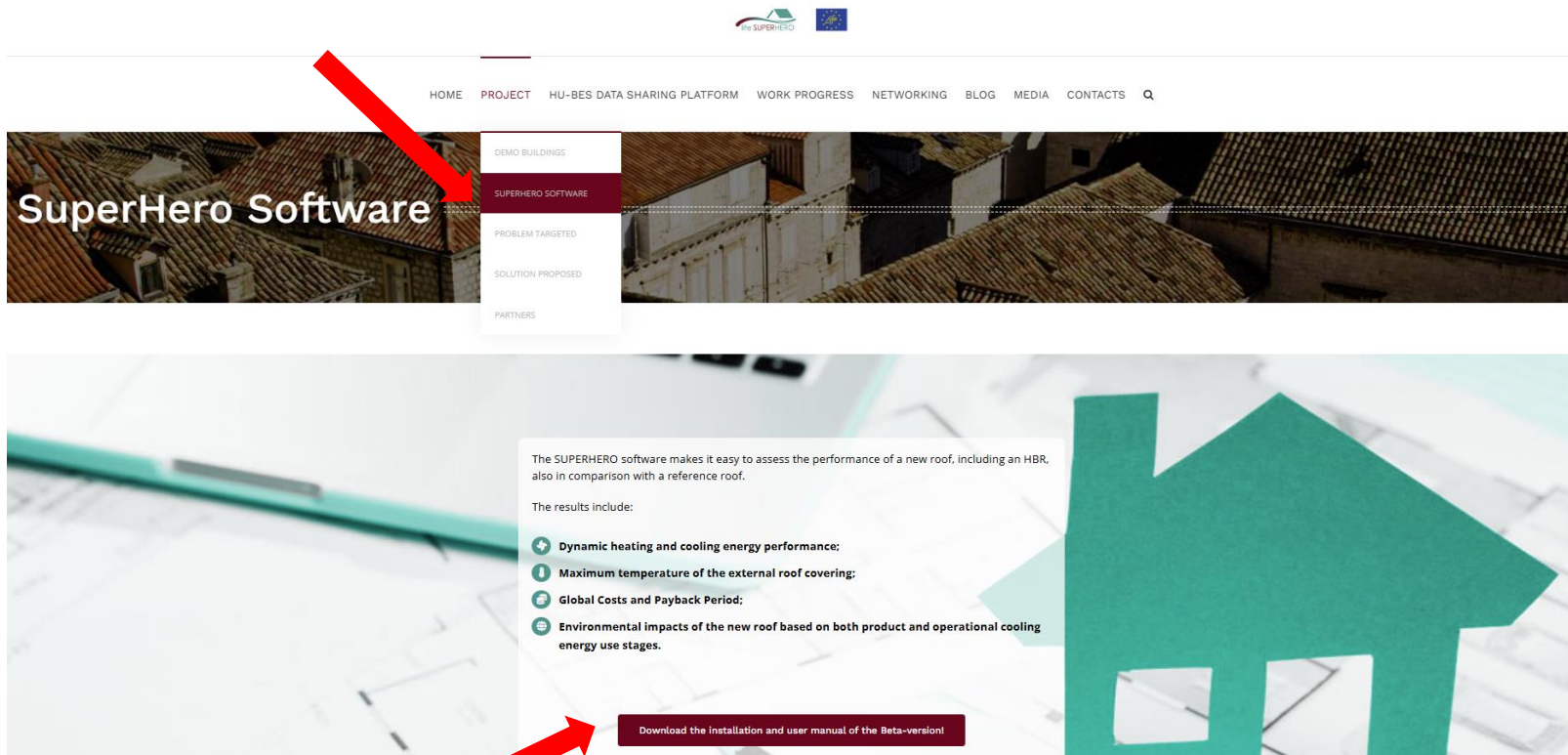
## *SUPERHERO software architecture and workflow*



# Where

*Beta version of the SUPERHERO software*

<https://www.lifesuperhero.eu/it/superhero-software/>



# Demonstration *Beta version of the SUPERHERO software*

Home

localhost:32770

life SUPERHERO

Home Export Edit Help

ROOF ENERGY PERFORMANCE LIFE CYCLE COSTING LIFE CYCLE ASSESSMENT

**Input Data**  
Energy simulation of an attic floor

Select Nearest Climatic Location

EUROPE

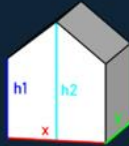
ITA - Italy

Ancona

Weather File Selected : Ancona

Attic Floor Type

Gable



Orientation and Geometry

N



# Contacts



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