30 years of bringing green ideas to LIFE

Permeable and ventilated roofs: an emerging solution for building comfort and climate mitigation in urban centers. The Project LIFE SUPERHERO

CLIMATE IS *LIFE*
ITALIAN PROJECT SOLUTIONS FOR FIGHTING CLIMATE CHANGE
9th November 2022
UNFCCC COP27 - SHARM EL SHEIKH

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Project Coordinator

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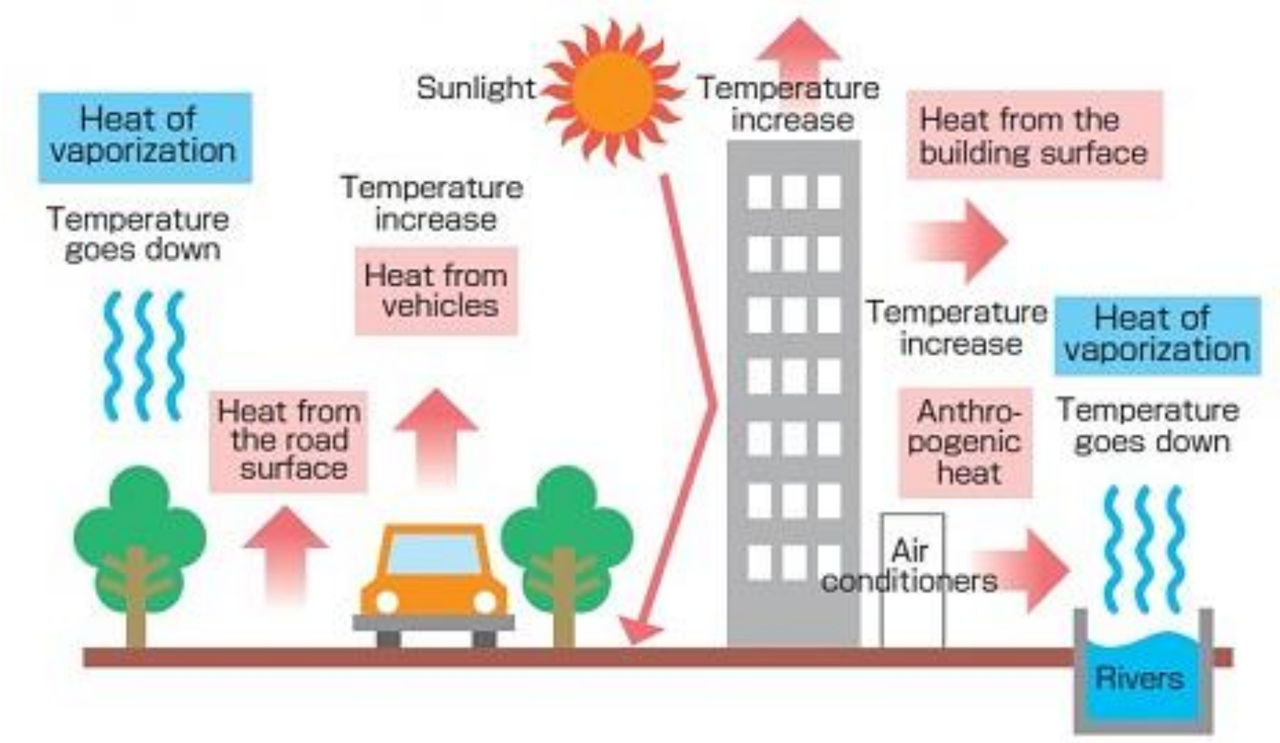
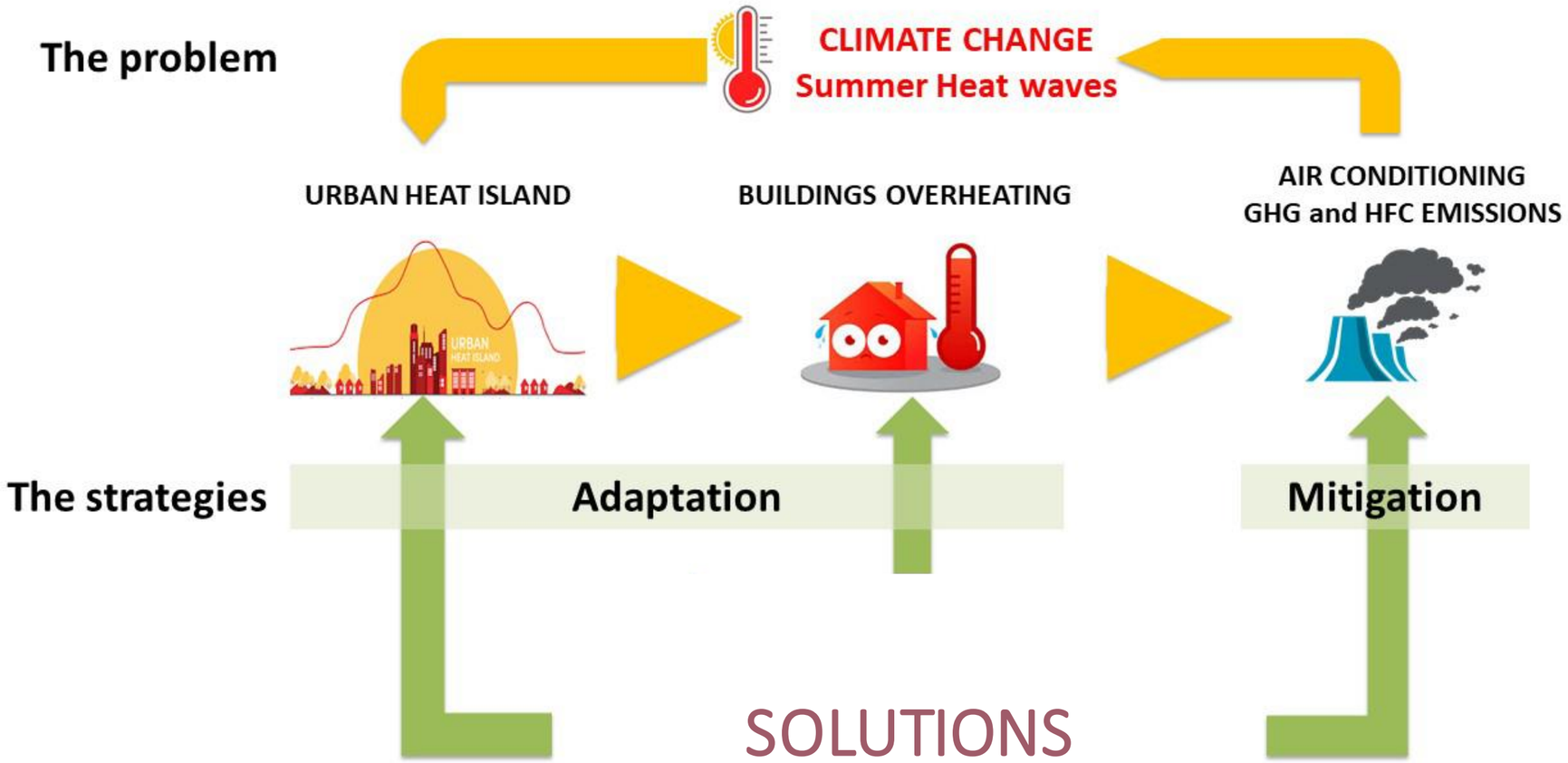
The problem targeted



THE URBAN HEAT ISLAND (UHI)

- No vegetation
- Urban material properties
- Urban geometry
- Anthropogenic heat
- Climatic conditions
- Geographic localization

The problem targeted



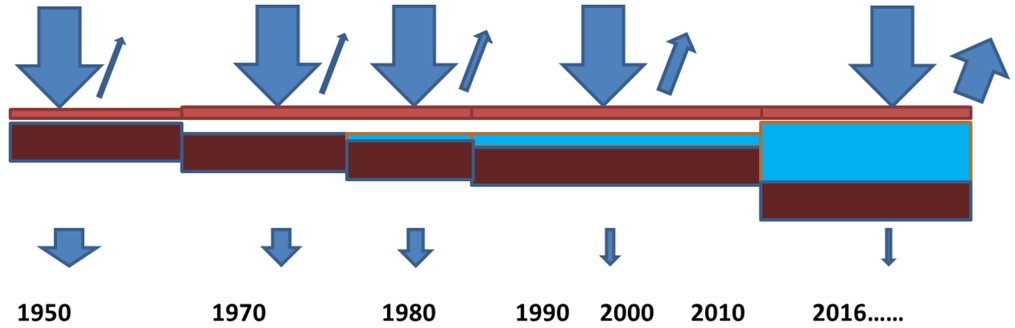
The International Energy Agency (IEA) has estimated that energy demand for building air conditioning will more than triple by 2050.

Current solutions

Actual EU policies / BRS / BGPP

Cool roof

Green roof

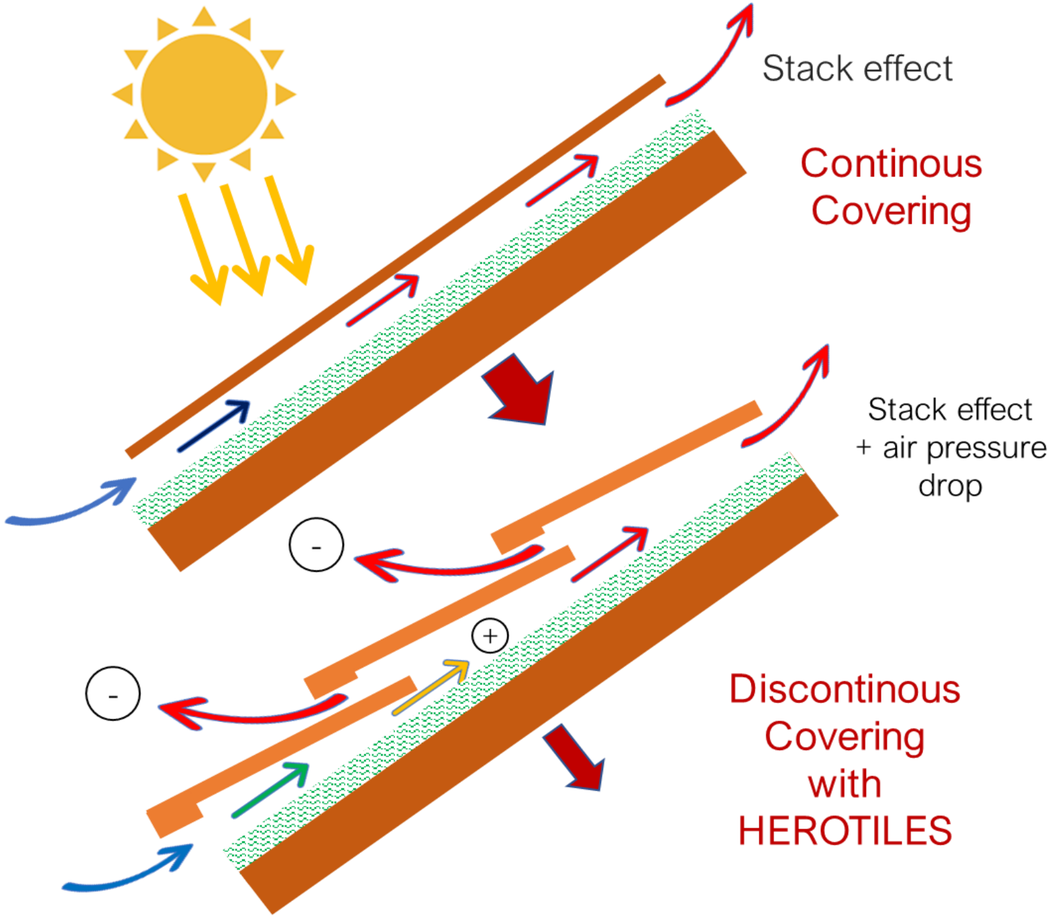


Isolation

Urban Heat Island (UHI)

Building energy saving

The solution proposed



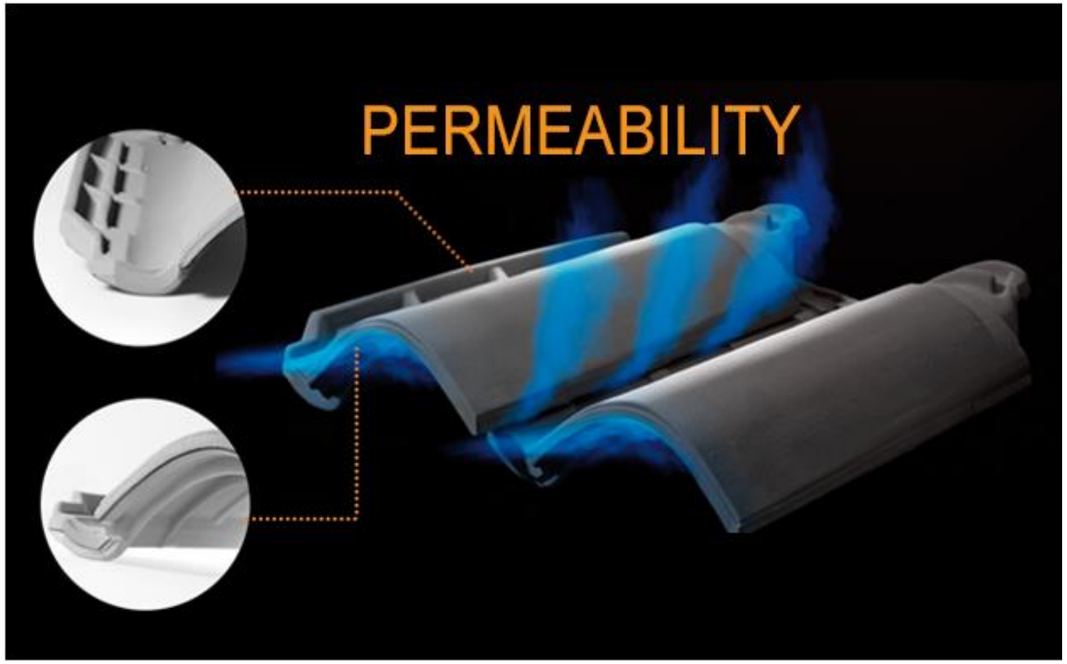
The use of Ventilated and Permeable Roofs (VPR) is the most sustainable and promising strategy to reduce building overheating.

A **vented roof** can be obtained through an air space between installed roof covering and the roof sheathing.

If this above sheathing ventilation is coupled to a high **“air permeability”** of the roof tiles, it is possible to obtain a considerable increase of the cooling performance

Background

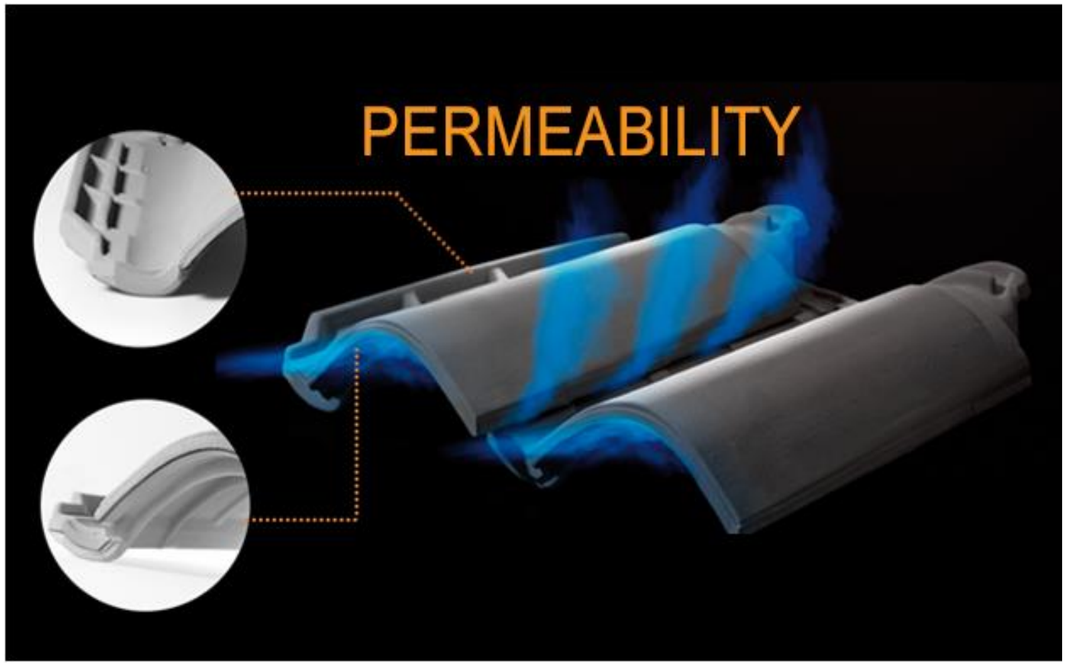
A previous project **LIFE HEROTILE** developed new types of roof tiles and demonstrated the effectiveness of the HEROTILES-based roof (**HBR**) in **reducing until 50% cooling energy** compared to other solutions.



Background

A previous project **LIFE HEROTILE** developed new types of roof tiles and demonstrated the effectiveness of the HEROTILES-based roof (**HBR**) in **reducing until 50% cooling energy** compared to other solutions.

General public, professionals and Building stakeholders, are not able to recognize the cooling potential of **ventilated permeable roofs** and, thus, are not aware of the environmental and economic benefits of these new technologies (**VPR & HBR**).



The SUPERHERO PROJECT

SUstainability and **PER**formances for **HERO**tiles – based energy efficient roofs

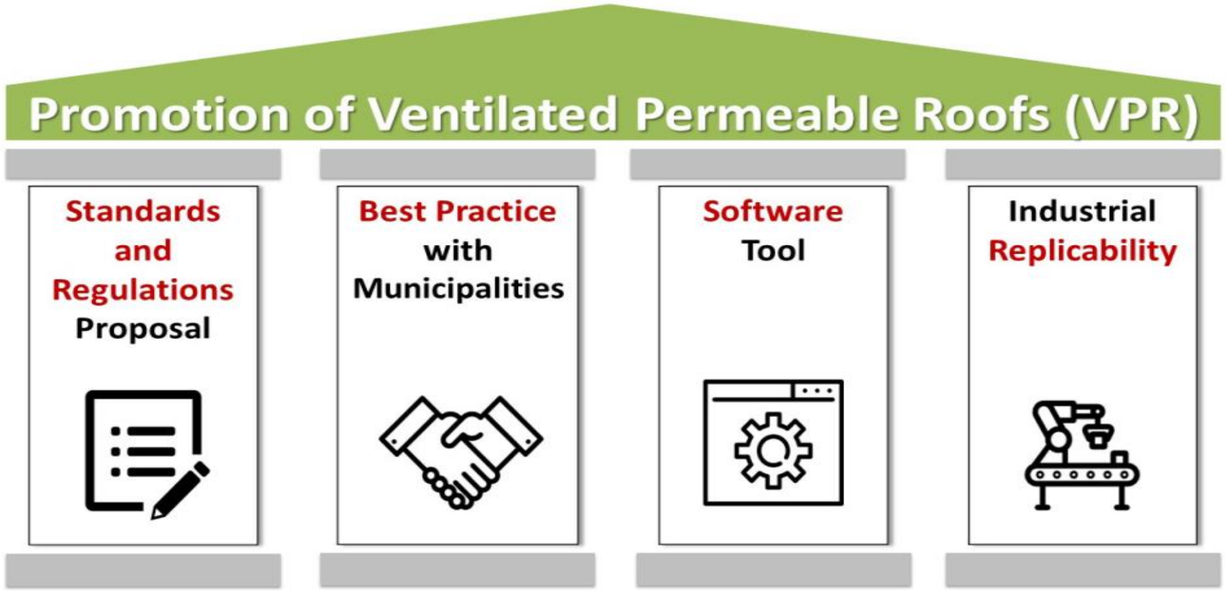
The consortium

SUPERHERO - LIFE19 CCA/IT/001194

- TOPIC: CLIMATE CHANGE ADAPTATION
- SECTOR: URBAN ADAPTATION/PLANNING
- TOTAL AMOUNT: 3,032,924€
- EU CONTRIBUTION: 1,563,160€ (55% of eligible costs)
- STARTING DATE: **1/07/2020**
- ENDING DATE: **30/06/2025**

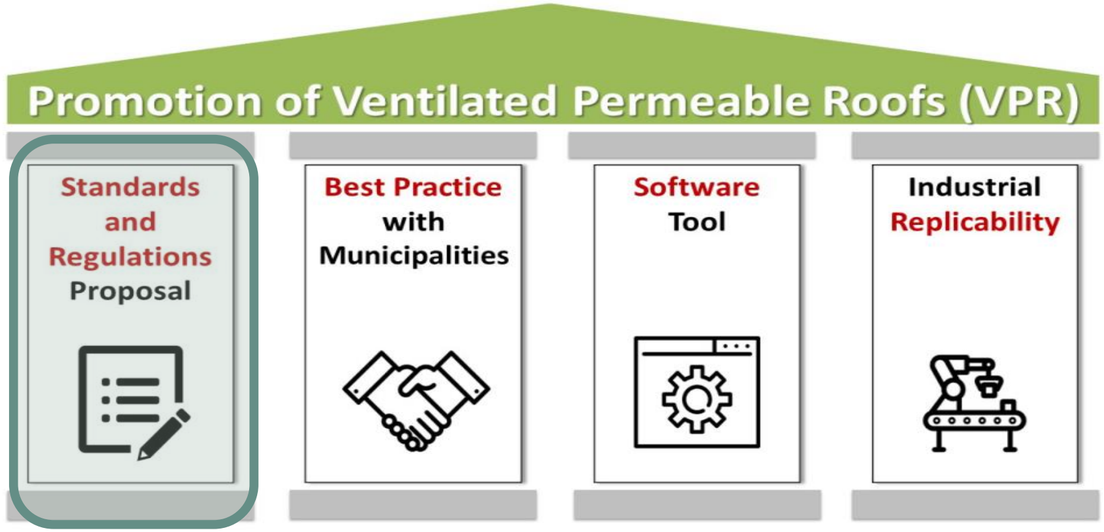
Objectives and Strategies

LIFE SUPERHERO is a **Best-Practice project**: it **promotes** the use of ventilated permeable roofs (VPR) as sustainable and cost-effective solutions for **building "passive cooling"**, increasing building occupants' and cities summer comfort (**adaptation**) and decreasing buildings' energy and green-house gasses emissions (**mitigation**). The strategy of the project is based on 4 pillars:



Action C.1

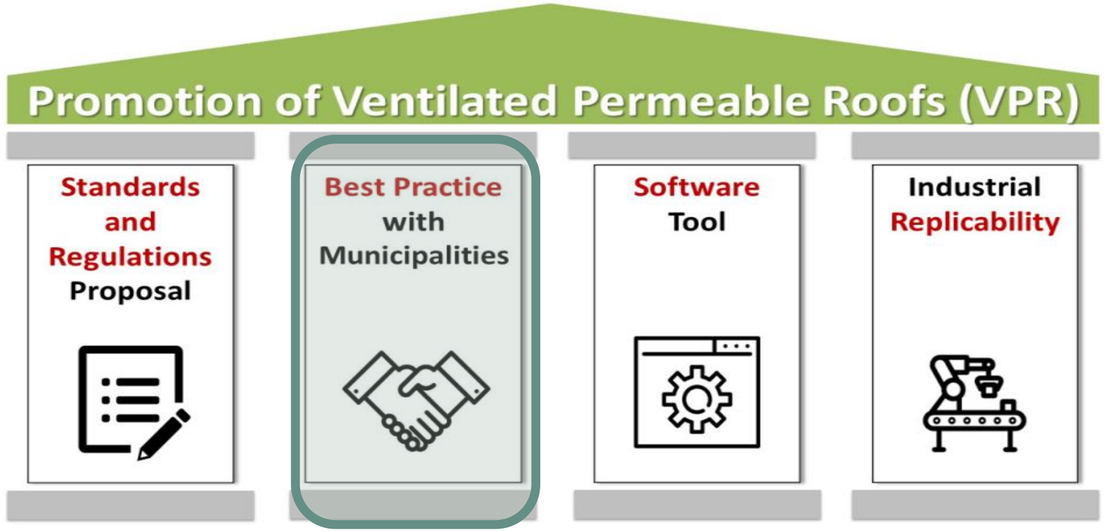
C1 Standards and regulations proposal: to overcome the existing policies, legislative and standard barriers to the diffusion of VPR and HBR, acting at different levels in terms of diffusion (national and EU) and technical scale (from product to building level), with:



- The production of a standardized **air permeability test method**
- The proposal of updating green rating systems and public procurement including **VPR environmental benefits**
- The proposal of **improving existing CEN** standards in order to include VPR into building energy calculation

Action C.2

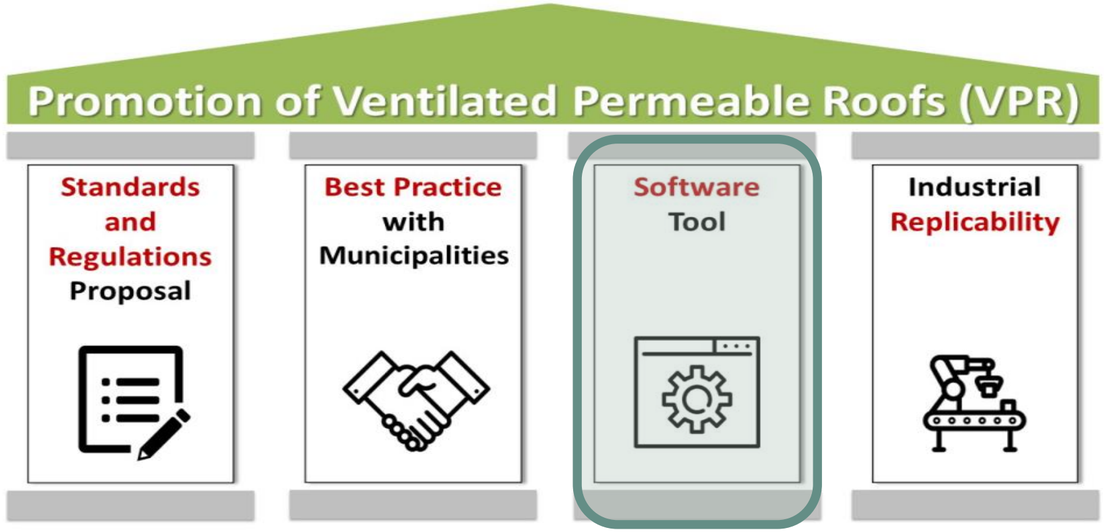
C2 Best practice for realization of HEROTILE-based roofs (HBR): to develop guidelines on proper roof renovation strategies to be used as climate solutions**.**



HBR will be installed on two buildings in Reggio Emilia, demonstrating its easy and cost-effective realization, while entailing high energy and environmental performance.

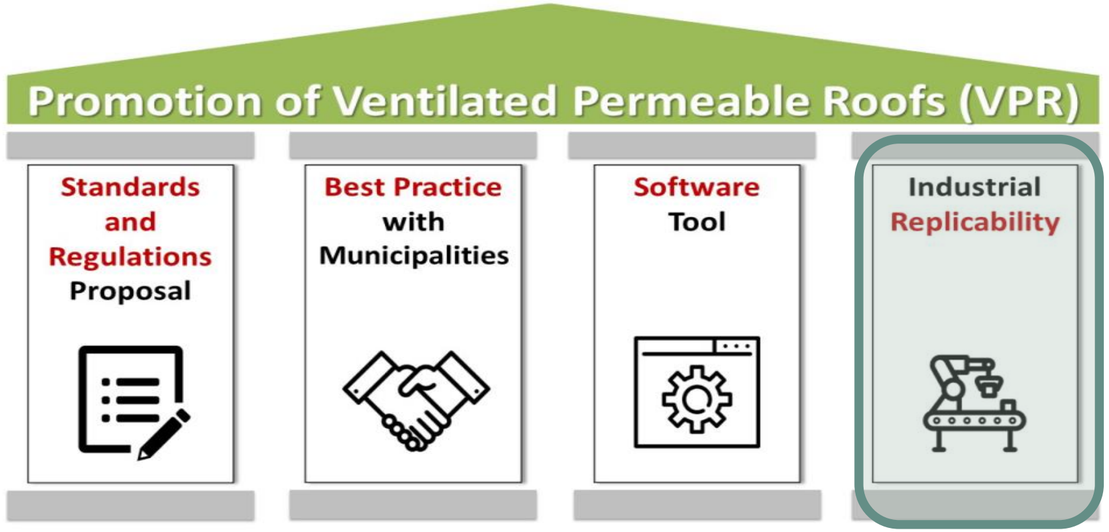
Action C.3

C3 Development of SUPERHERO software: a decision support tool for building consultants and public administrations to assess life-cycle environmental and economic benefits of VPR and HBR, in order to select the best design solutions.



Action C.4

C4 Replicability, transferability and best practice creation for tile producers:
this action involving all partners, especially the tile & brick industries and associations, will set the basis for a strong market penetration of VPR and HBR, thus amplifying the climate impacts obtained by the project.

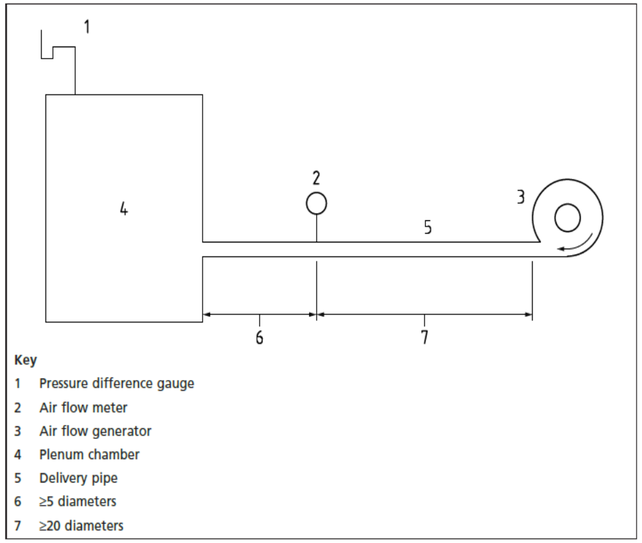


C.1-Air Permeability Test

HOW

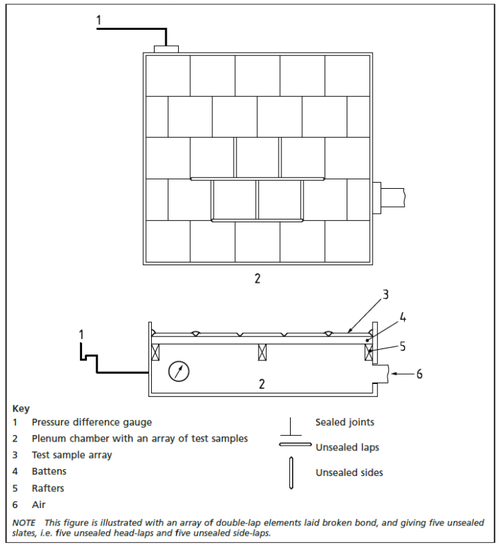
A **Round-Robin test** will be arranged to characterize the VPR performance in 4 independent laboratories (CC, UNIVPM, CTMNC, BMI) to introduce the parameter “**air permeability**" of the roofing system into an **European Technical Assessment (ETA)** and **CEN standard**

Figure L.1 **Arrangement of apparatus**



Key
1 Pressure difference gauge
2 Air flow meter
3 Air flow generator
4 Plenum chamber
5 Delivery pipe
6 ≥5 diameters
7 ≥20 diameters

Figure L.2 **Plenum chamber arrangement for air permeability test**



Key
1 Pressure difference gauge
2 Plenum chamber with an array of test samples
3 Test sample array
4 Battens
5 Rafters
6 Air

Sealed joints
Unsealed laps
Unsealed sides

NOTE This figure is illustrated with an array of double-lap elements laid broken bond, and giving five unsealed slates, i.e. five unsealed head-laps and five unsealed side-laps.

$$C_d = \frac{Q_c}{A} \frac{1}{\sqrt{\frac{2\,\Delta p_c\, g}{\rho}}}$$

British Standard BS 5534 – Annex L: Method of test for air permeability of unsealed small element roofing assemblies

C.1-Air Permeability Test

HOW	3 partners (EDILIANS, ICP, TERREAL) will supply 18 type of roof tiles to be tested, to cover almost all different typologies of roof tiles available on the market: curved and flat, moulded and extruded. The test will be done also on 2 HEROTILES roof tiles (to be used in Actions C2 & C4).

British Standard BS 5534 – Annex L: Method of test for air permeability of unsealed small element roofing assemblies

C.1-The regulation in Italy

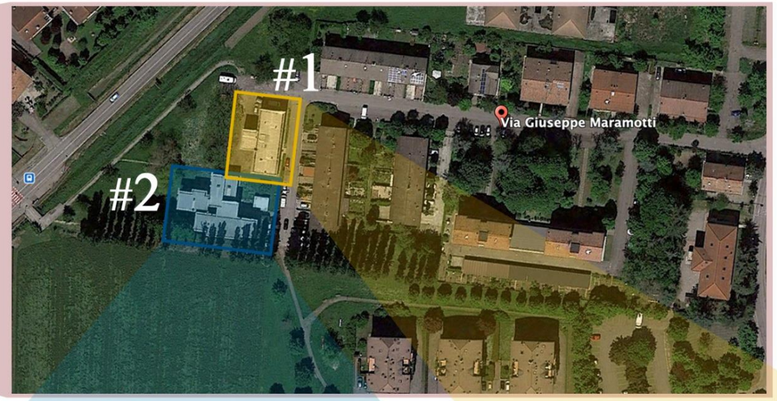
REGULATORY INSTRUMENT	STRATEGY N.1	STRATEGY N.2
Italian building code DM 26 giugno 2015 “Requisiti minimi”	Roof solar reflectance -0,65 (flat roof) -0,30 (tiled roof)	Passive cooling technologies (e.g.: ventilation, green roofs)
Italian Building GPP DM 11 ottobre 2017 CAM **(Rev. 06/08/2022)**	Green Roofs **Ventilated Roofs**	SRI greater than: -29 (slope > 15%) -76 (slope < 15%)
Building green rating system “Protocollo Itaca”	Green Roofs	SRI greater than: -29 (slope > 8,5°) -76 (slope < 8,5°)
Building green rating system “LEED”	SRI (after 3 years) greater than: -32 (slope > 15%) -64 (slope < 15%)	Green Roofs

During the revision of CAM we managed to include the ventilated roof in the design criteria as a solution to UHI effect

C.2-LIFE SUPERHERO buildings

HBR will be installed on two buildings in Reggio Emilia, demonstrating its easy and cost-effective realization, while entailing high energy and environmental performance.

LIFE SUPERHERO buildings Pilots



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C.2-Renovation/monitoring plan

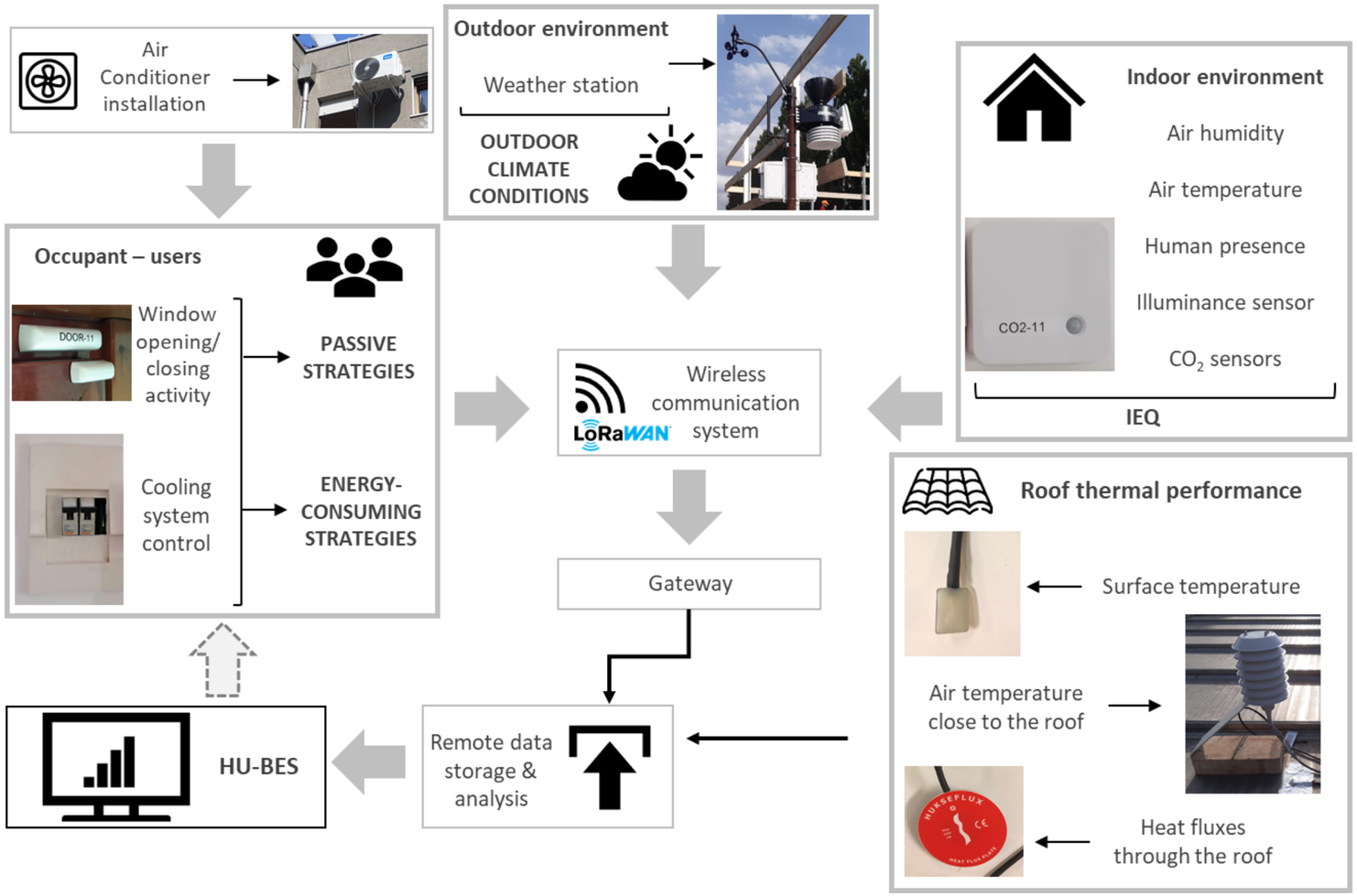
2021	2022	2023	2024

Existing state

Renovation of vertical envelope

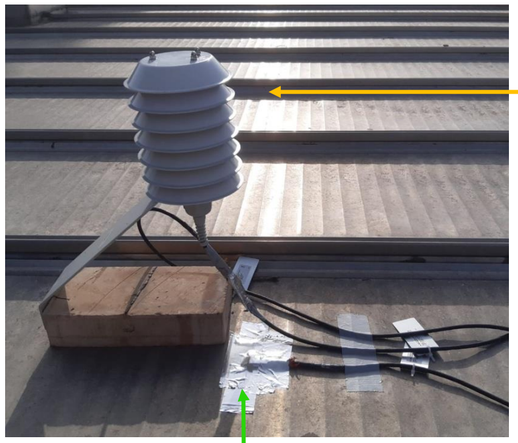
Addition of attic with HBR

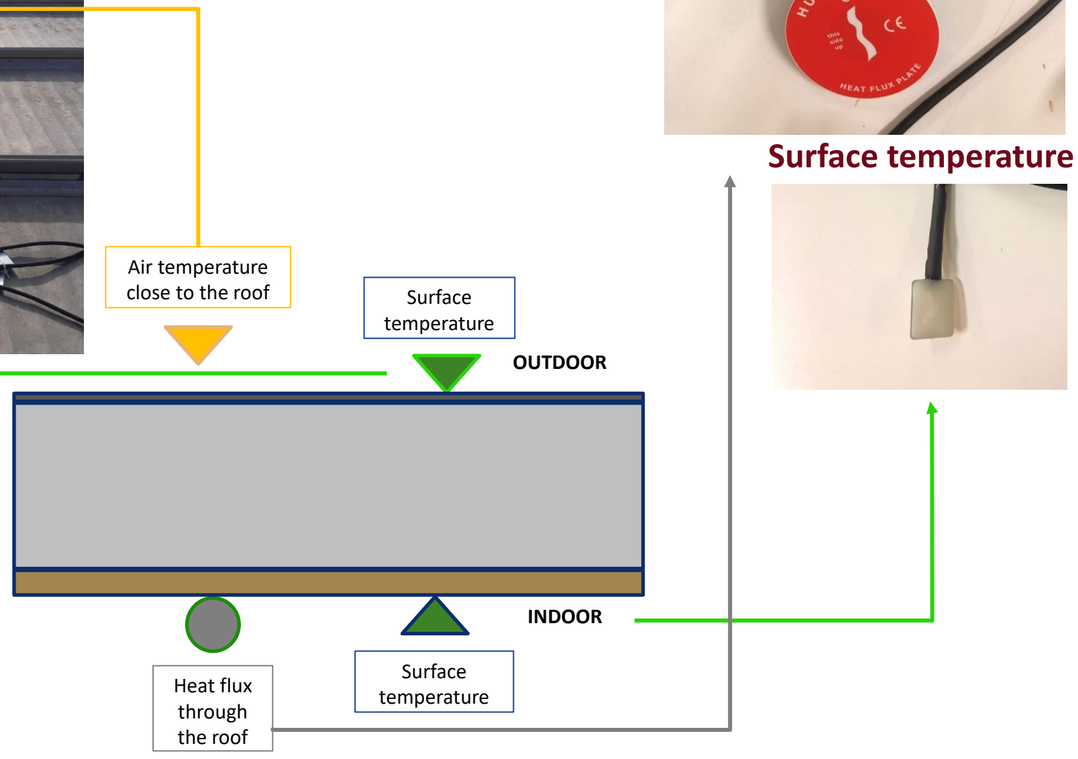
C.2-The monitoring system



C.2-The monitoring system

Surface and air temperature





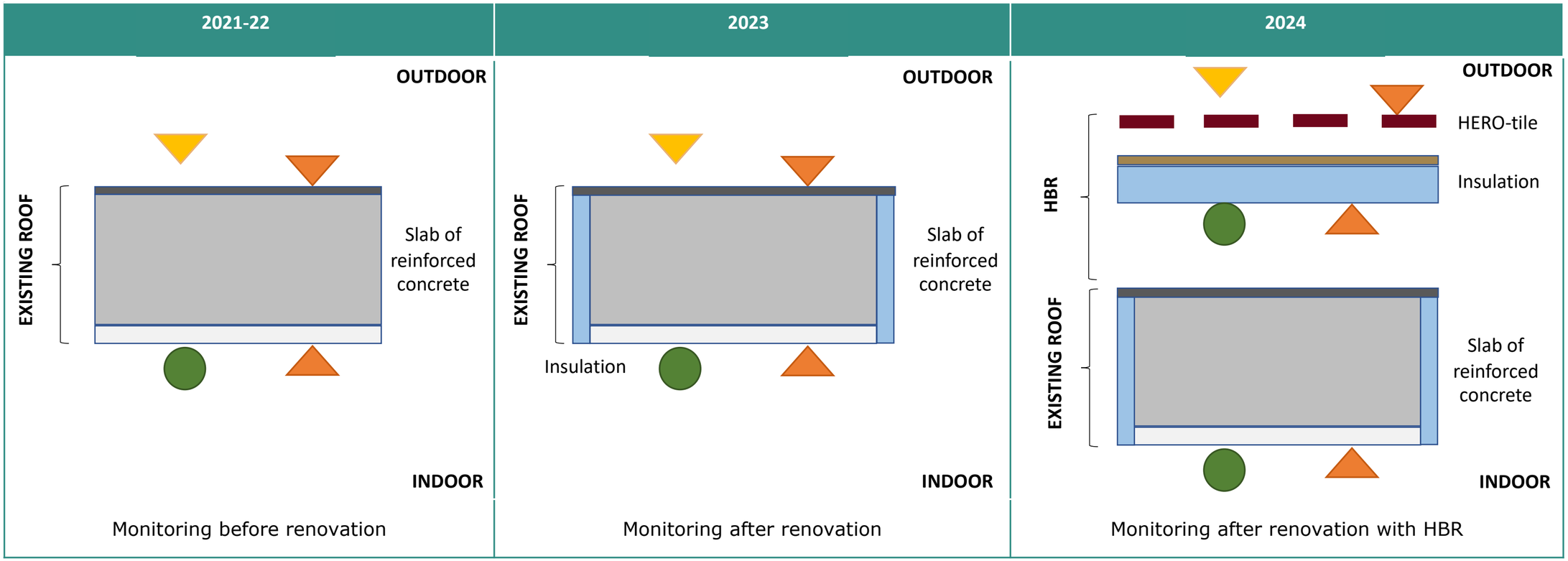
Heat flux probe

Surface temperature

Sensors to monitor the actual roof thermal performance:

- Outdoor surface temperature
- air temperature near the roof surface
- indoor surface temperature
- incoming heat flux through the roof

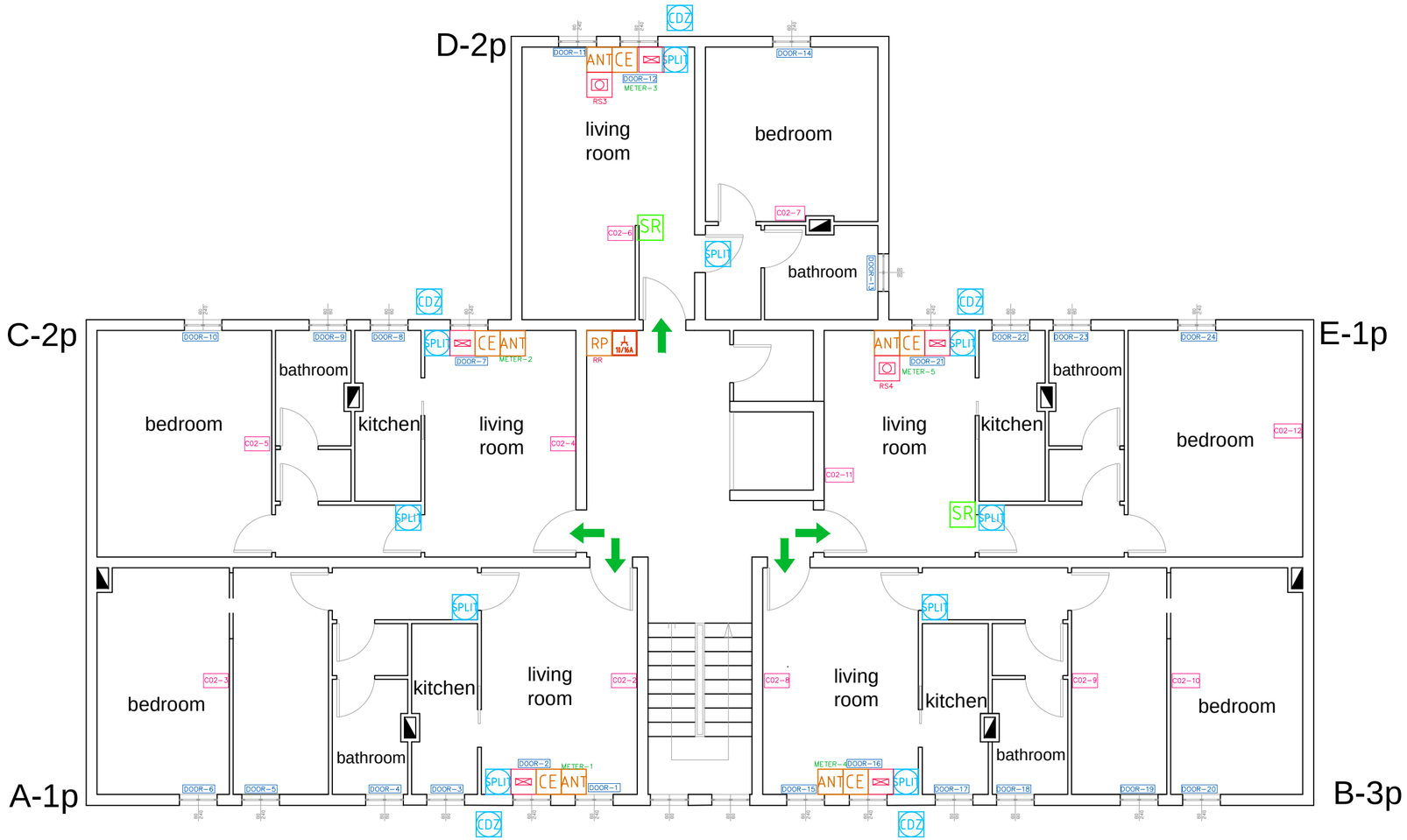
C.2-The monitoring system



PROBES:

- Air temperature close to the roof
- Heat flux through the roof
- Surface temperature

C.2-The monitoring system



CDZ	Air conditioning - external unit
SPLIT	Air conditioning - internal unit
ANT CE	Panel equipped with: Energy counter Antenna
RP	Box - electrical panel and repeater device with RLOG
AK	Storage and data transmission box (RLOG)
SR	Indoor surface temperature and heat flux probes (RLOG)
	RLOG tool (acquire and store surface temperature and heat flux sensors data)
CO2-1	Air temperature, humidity, CO2, light device Elsys ERS CO2
DOOR-1	Open activity sensor (windows) Elsys EMS DOOR
BOX	Storage and data transmission box (ELOG)

C.2-The HU-BES platform

HU-BES
(HUman BEhaviors monitoring data Sharing)

Covenant of Mayors for Climate & Energy EUROPE

Climate ADAPT
SHARING ADAPTATION KNOWLEDGE FOR A CLIMATE-RESILIENT EUROPE

- UNIVPM
- ACER & project partners
- Building occupants
- External users

Stakeholders

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Benefits of VPR and HBR

Reduction of roof internal and external surface temperature

Increase of indoor comfort

Reduction of building energy consumption

Use of low-cost, durable and sustainable materials

Reduction of UHI effect

Reduction of Greenhouse Gases emissions (GHG)

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Thank You!

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