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

Project Conference BAU Monaco

16 JANUARY 3 30 PM

Room A 310

MARIO CUNIAL LIFE SUPERHERO

life SUPERHERO

SUstainability and PERformances for HEROTILE-based energy efficient roofs

https://www.lifesuperhero.eu/it/

https://www.cottopossagno.com/

Mario Cunial

- Board member and R&D-S director

Industrie Cotto Possagno spa

- Vice-president CERAME-UNIE
- Member Roof Tiles Product Group T.B.E.
- Coordinator LIFE Projects
  HEROTILE and LIFE CAP TILE
  Partner LIFE SUPERHERO
- President T.G. building Materials and
  board member Confindustria Veneto Est
- Board member Confindustria
  Ceramica
- Board member ICMQ
- Member experience of TG CEN 128 SC3 ,
  CEN 107,
- Member G.T.A. & S. Confindustria,
- Member Sustainability Commission
  Confindustria Ceramica

RINA

CERTIFICAZIONE DELLE COMPETENZE
PROFICIENCY CERTIFICATION

CERTIFICATO N. **CCM-475/19**
CERTIFICATE No.

SI CERTIFICA CHE
IT IS HEREBY CERTIFIED THAT

Mario Cunial

nato/a a *Born in* BASSANO DEL GRAPPA (VI) il *on* 28/09/1962

SODDISFA I REQUISITI SPECIFICATI NEL
MEETS THE REQUIREMENTS SPECIFIED IN THE

Disciplinare per la valutazione e la certificazione delle competenze manageriali (rev. 10/2019)

emesso da **FEDERMANAGER** /issued by ***FEDERMANAGER***

per le seguenti tipologie di manager/consulenti di direzione
for the following types of manager/management consultans

Manager per la sostenibilità

Manager che assicura la definizione e la gestione di politiche di impresa volte al perseguimento di obiettivi di Sostenibilità, favorendo la crescita e lo sviluppo durevole dell'azienda.
A manager who ensures the definition and management of business policies aimed at achieving sustainability objectives, fostering the company's growth and development.

Employment background
Economic sector: *Manufacturing not elsewhere classified*
Enterprise size: *MEDIUM (<250 employees and annual turnover = 50 million euro)*
Nature of ownership: *private family, private management*

Prima emissione *First issue*	23.12.2019
Emissione corrente *Current issue*	22.12.2022
Data scadenza *Expiry date*	22.12.2025

Filippo Lago
(Italy Welding & Pressure Equipments, Personnel Certification & Laboratories Director)

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Via Corsica 12 - 16128 Genova Italy

Il presente certificato è composto da 1 pagina
This certificate consist of 1 page

ACCREDIA
PRS N° 066 C
Membro degli accordi di mutuo Riconoscimento EA, IAF e ILAC
Signatory of EA, IAF and ILAC Mutual Reposition Agreements

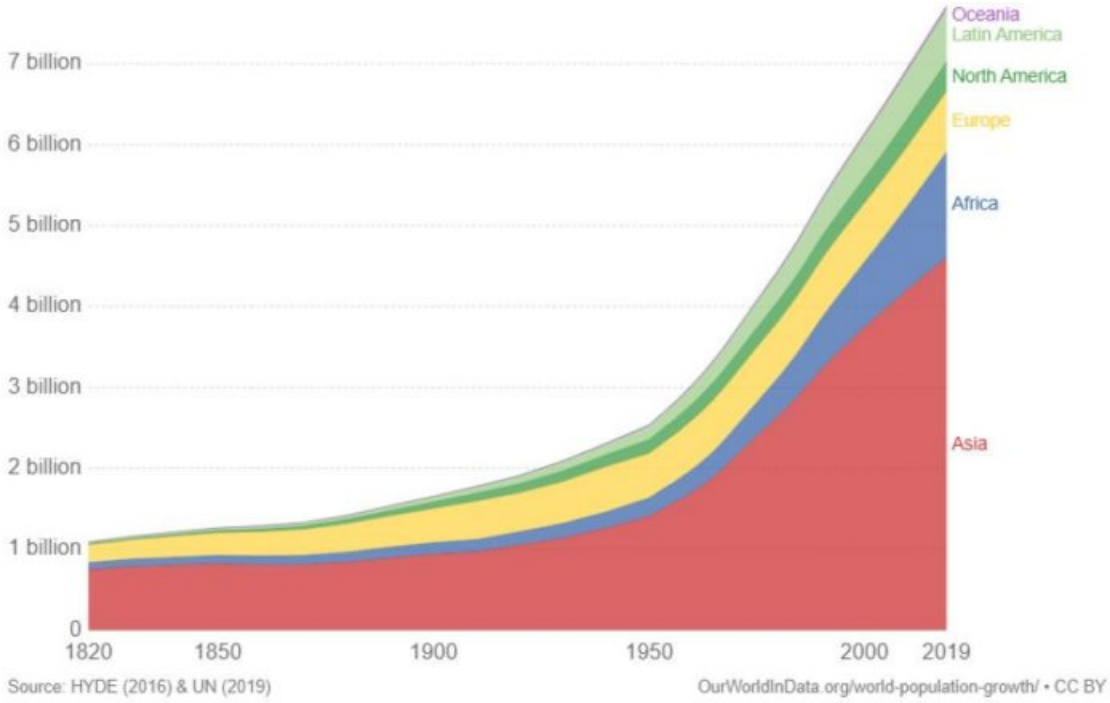
the climate has changed

there is a worrying increase in temperatures and increasingly intense winds and storms

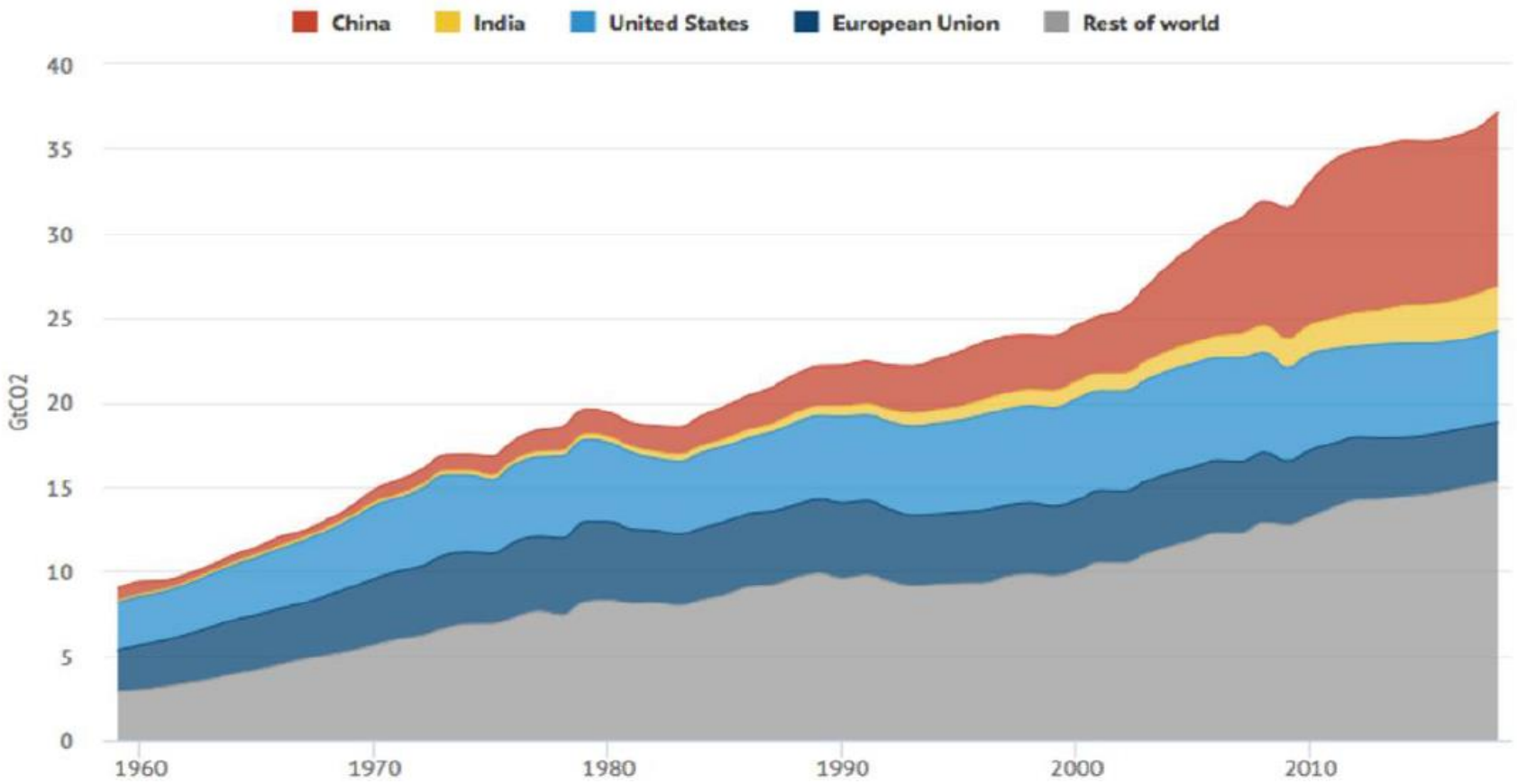

the climate has changed
Devastating effects for the Planet andand future generations.

Population trend (by continent)

1820 - 2020



CO2 emissions trend (by continent)



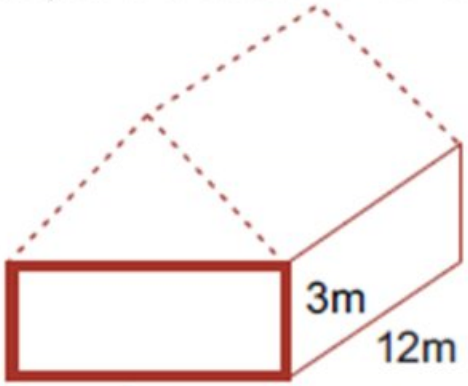
URBAN HEAT ISLAND EFFCT

Construction in the World is the sector that has the greatest impact on the environment: buildings alone account for 38% of all carbon dioxide emissions.

Beginning before project

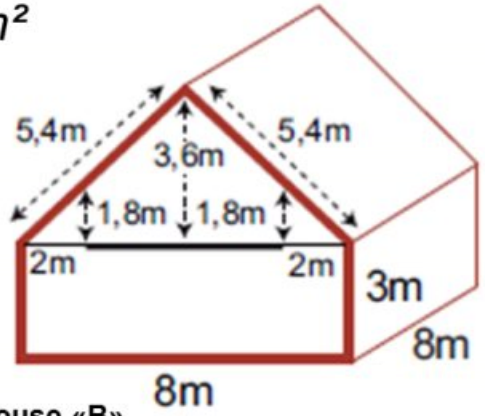
AND

We compare 2 houses of "different shapes", but which have the same living area: 96 m²



House «A»
With empty attic or roof terrace
Living area: 96 m²
Low floor: 8x12 = 96 m²

External walls (floor included): 312 m²
Low floor: 8x12 = 96 m²
Ceiling: 8x12 = 96 m²
Facades: (3x12) x 2 = 72 m²
Sprockets: 3x8x2 = 48 m²



House «B»
With sloping roof and habitable attic
Living area: (height> 1.80 m) 96 m²
Low floor: 8x8 = 64 m²
High floor: 4x8 = 32 m²
External walls (floor included): 275 m²

With an equivalent living area, the house with habitable attic is more compact, and therefore presents less heat dispersion surfaces than the house with empty attic or roof terrace

Beginning before project

lack of reference legislation, the covering of a building is in fact the skin and is not considered

BUT

In today's world, where the environmental behaviour of a house is of increasing concern, the pitched roof has an important part to play. Depending on the design of a building, it can bring many environmental benefits.

STUDIES PROVE IT

A recent study has compared the environmental performance of single family houses with different roof solutions on the basis of the most commonly used indicators for building assessment (standard EN 15804).

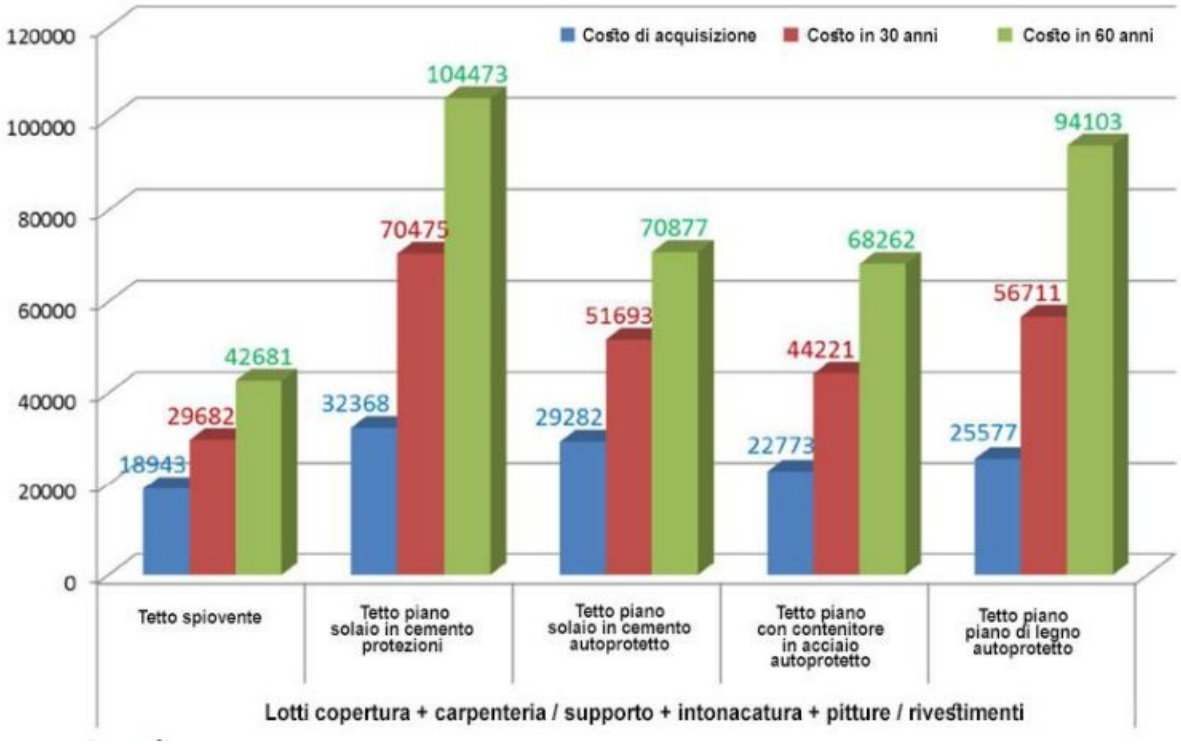
Using the tool GPRBouwbesluit and the Environmental product database of the Netherlands, the study showed that a pitched roof house with clay tiles performs much better than comparable flat roof houses, notably:

- 41% better than a 2 storeys house with a concrete flat roof;
- 21% better than a 3 storeys house with a concrete flat roof;
- 25% better than a 3 storeys house with a green flat roof.

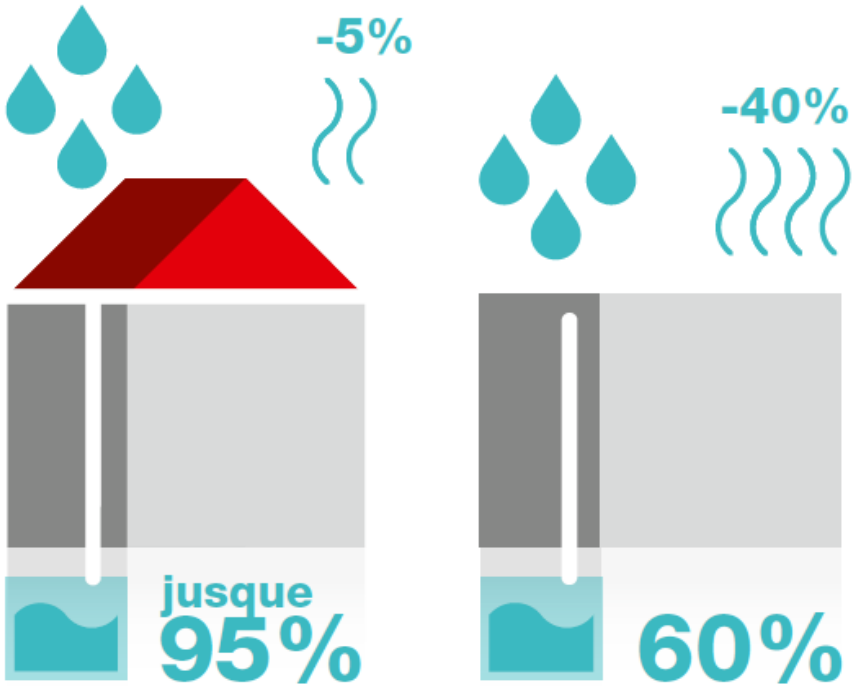
	Pitched (45°)	Flat	Flat	Flat green
				
Number of storeys	3	2	3	3
Gross floor area (m2)	139.2	93	139.2	139.2
Structure of the roof	wood/clay tiles	concrete	concrete	concrete/ sedum
Environmental score (in comparison to pitched roof)		+41%	+21%	+25%
Contribution of the roof to the overall impact of the building	7.7%	14.2%	11.1%	14.6%

Source: Environmental assessment of flat and pitched roof, KNB, the Netherlands, 2015.

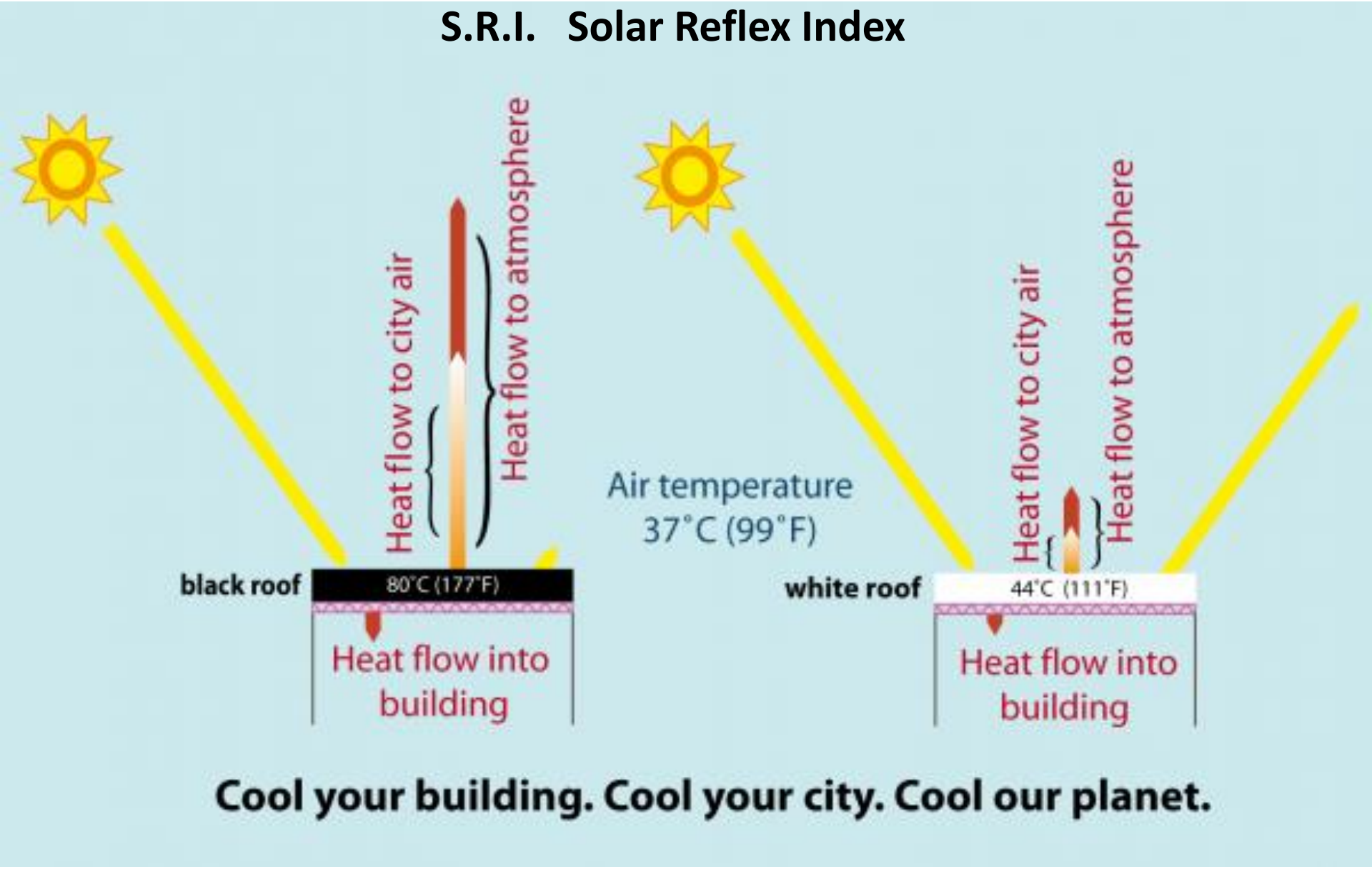
Example 3: Global cost calculation +30 and 60 years



water collection



S.R.I. Solar Reflex Index



Fonte: https://heatisland.lbl.gov/coolscience/global-cooling

Historical and aesthetic value

HEROTILE

High energy savings in the cooling of buildings by the Roof tiles shape optimization through a better above sheating ventilation

(LIFE14 CCA/IT/000939)

The European Commission is looking at cost-efficient ways to make the European economy more climate-friendly and less energy-consuming.

Its **low-carbon economy** roadmap suggests that:

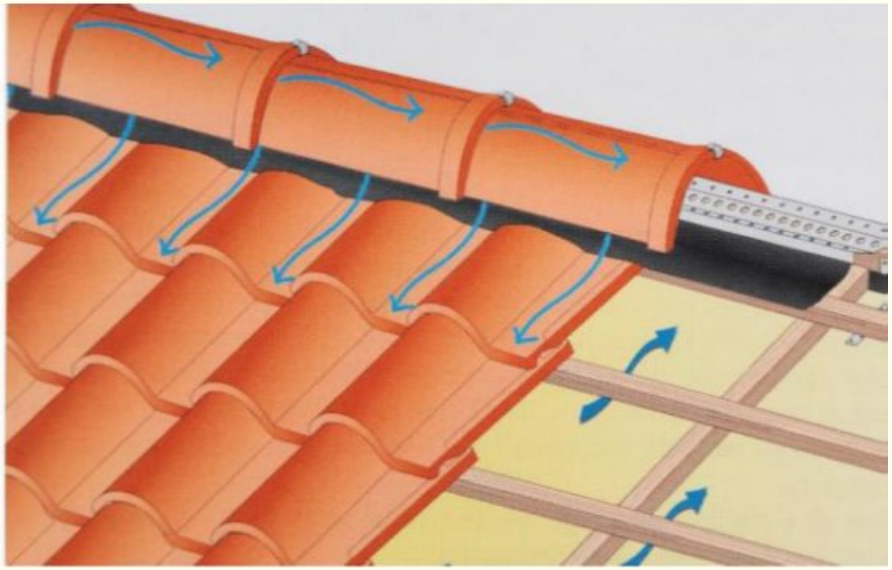
- Within the 2050, the EU should cut greenhouse gas emissions of the **80% -** below the levels in 1990.
- The milestones to achieve this goal are the **40% cuts of the** emissions within the **2030** and of the **60% within the 2040.**
- **All the sectors** need to contribute.
- The way to get to the low-carbon economy is **feasible & affordable**.

1. Summary of project scope and objectives

1.1 Project scope

In the Mediterranean area, summer radiation could drive to the overheating of buildings coverings (roofs and walls). Thus, the air-conditioning would become more and more essential.

A ventilated roof could be a great solution to reduce solar infiltration through the tiles, because of moved air, which reduces part of heating due to solar radiation. This effect could be enhanced by increasing the permeability of air through tiles. It modifies the mould of tiles, without invalidating the original appearance and impermeability.



LIFE Herotile aims to improve the energy behavior of the buildings through the development of innovative types of roof tiles able to increase their underlay ventilation.

Thanks to technologies and systems suitable for being replicated, transferred or mainstreamed, the project will contribute therefore to the development and implementation of energy savings approaches, mainly at Mediterranean Region, and to climate change mitigation.

2. Description of the techniques/methodology implemented and results achieved

2.1 Project activities

In order to help the EU construction sector (refurbishment and new constructions) to achieve its energy efficiency targets and related CO2 emissions and to facilitate the global market uptake of an eco-innovative EU product able to help reaching these objectives, LIFE HEROTILE Project developed:

TWO NEW TYPES OF ROOF TILES (PORTUGUESE AND MARSEILLAISE TILES)

with a shape characterized by a higher air permeability through the overlap of the tiles, and then a better energy performance by passive disposal of the solar radiation through under-tile ventilation.

The new tiles were design using the tridimensional model CFD tested in several conditions. The CFD model have been implemented to understand how much the roofing tiles could have affected the air permeability.

Results were collected in conditions that simulated different directions and intensity levels of wind. They provided essential data useful to conceive a new type of tiles, able to increase the quantity of circulating air under tile, without discourage the sealing of water. The new tiles were also tested in rain wind tunnel to check their driving rain performance.

Progetto Life-Herotile - GOALS

The aim is to **enhance the energy performance of buildings**, through the development of **new roof tiles, with increased ventilation capabilities**.

Project Location

Italy, France, Germany, England, Spain and Israel.

Cost of the project

2.515.306,00 € | 60% EC Co-funding

Duration

2015 – 2019

Partners

Progetto Life-Herotile – GOALS

-57%

Reduction of specific **cooling power**

-50%

Reduction of the **carbon footprint**

-50%

Reduction of the **inlet watts to be cooled** in comparison with a non-ventilated roof

-25%

Reduction of maximum **temperature** peak of the **under-tile airflow**

-10%

Reduction of **greenhouse gases emissions**

-5%

Reduction of **atmosheric pollution**

Life-Herotile Project - ACTIONS

1. Tiles **shape optimization** for progressing in the above sheathing ventilation and energy savings.

2. 2 **pilot plants** for the productions of new types of roofing tiles in Italy.

3. 2 **construction tests in real scale**, i

4. 2 **real buildings**, in Italy and in Spain.

5. **SENSAPIRO**, **S**oftware **EN**ergy **SA**vings **PI**tched **RO**ofs

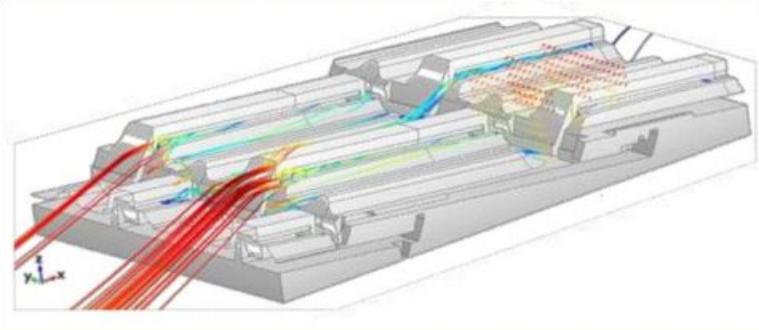
Action 1 | Shape optimizaion CFD ANALYSIS

Basis

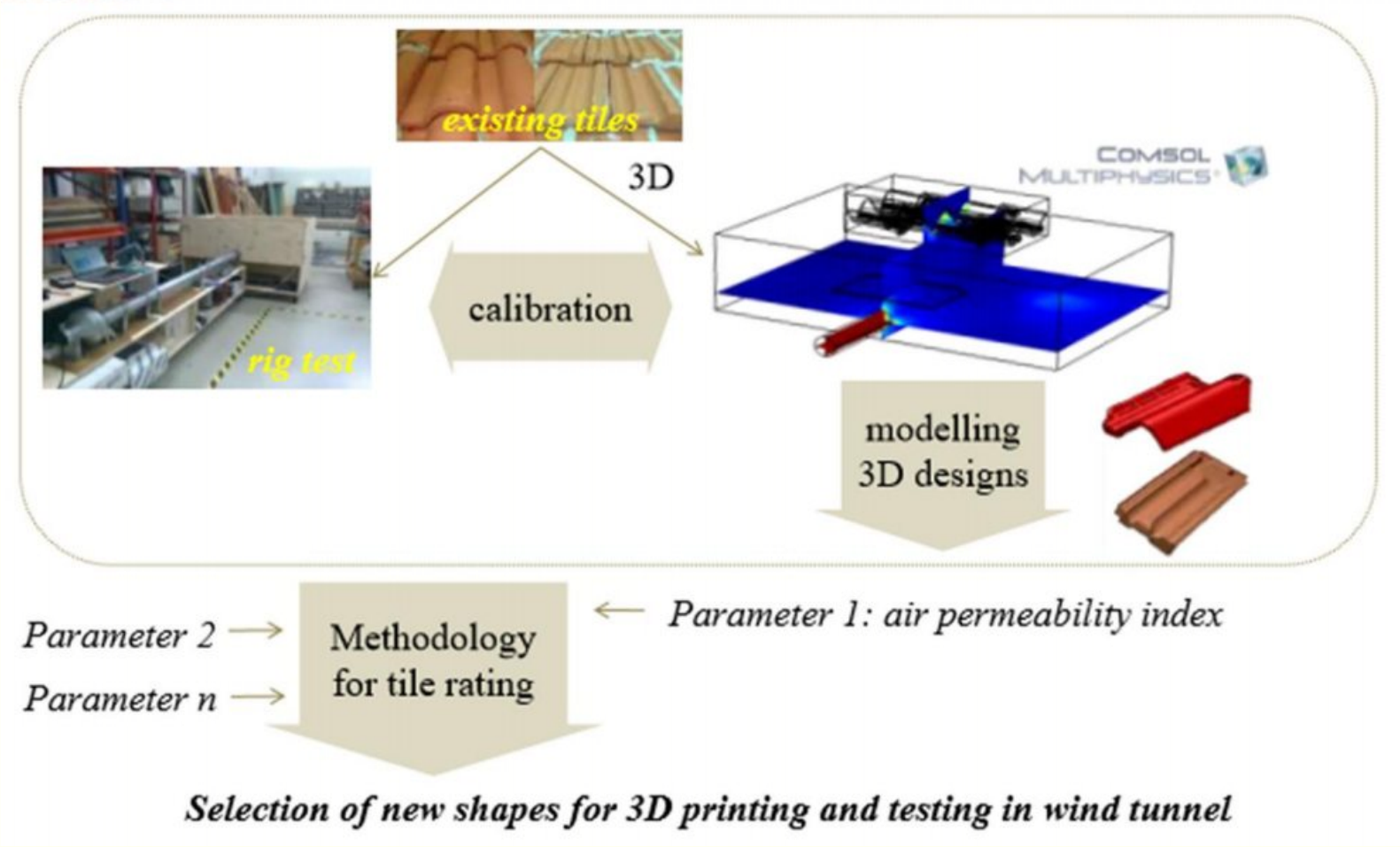
The CFD model had been implemented to understand **how much the roofing tiles could have affected the air permeability.**

Consequences

The results have substained the application of such basis on a funding of the UE project, or that part of the project which aims to improve the permeability of the ventilated roof's air in warm and mild climates to increase the insulation of the passive buildings.



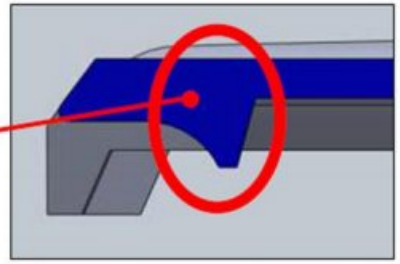
Action 1


existing tiles
3D
COMSOL MULTIPHYSICS
rig test
calibration
modelling
3D designs
Parameter 2
Parameter n
Methodology
for tile rating
Parameter 1: air permeability index
Selection of new shapes for 3D printing and testing in wind tunnel

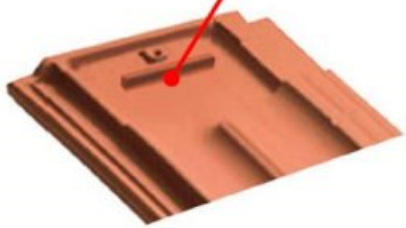
Action 1

new tile, marsigliese variation type 8 and 9

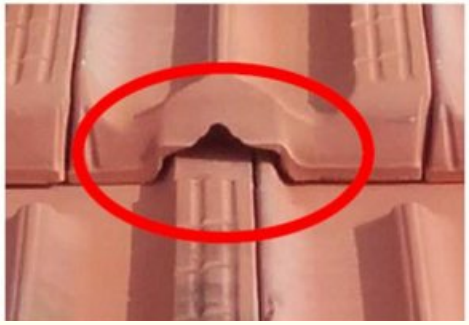
waterproof adjustment by lowering internal flap
(longitudinal section in the front)



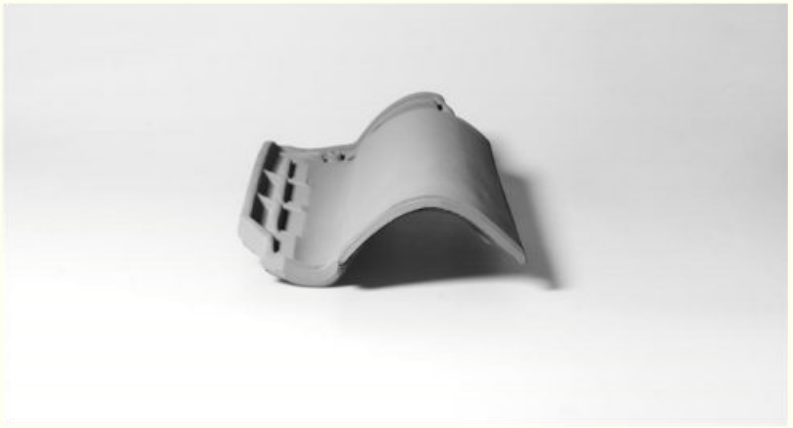
adapting rear labyrinth

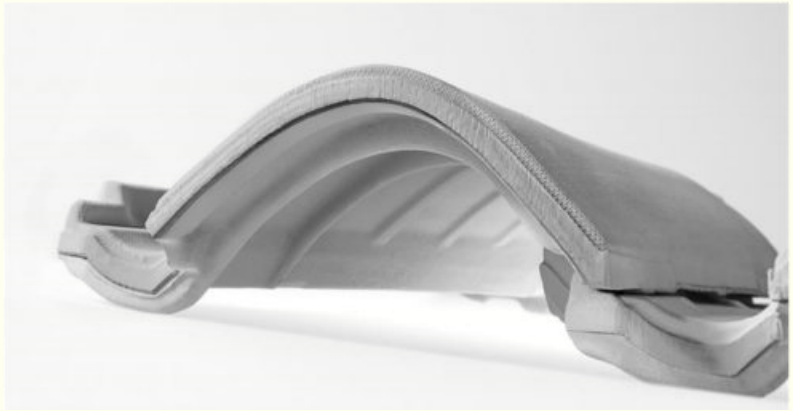


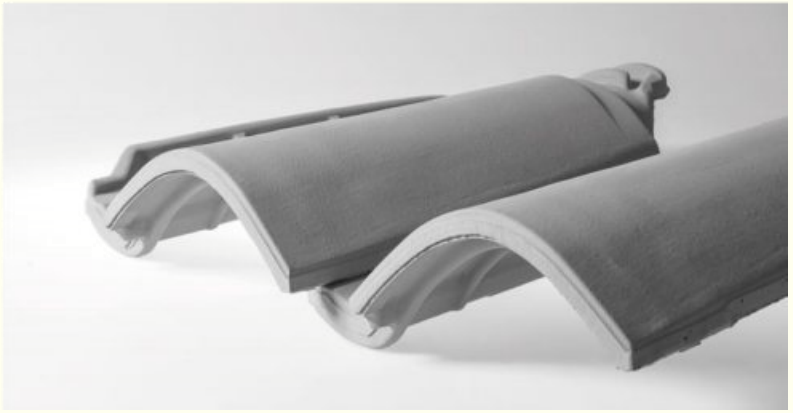
opening a small	or large slot on the front	(*different shape*)



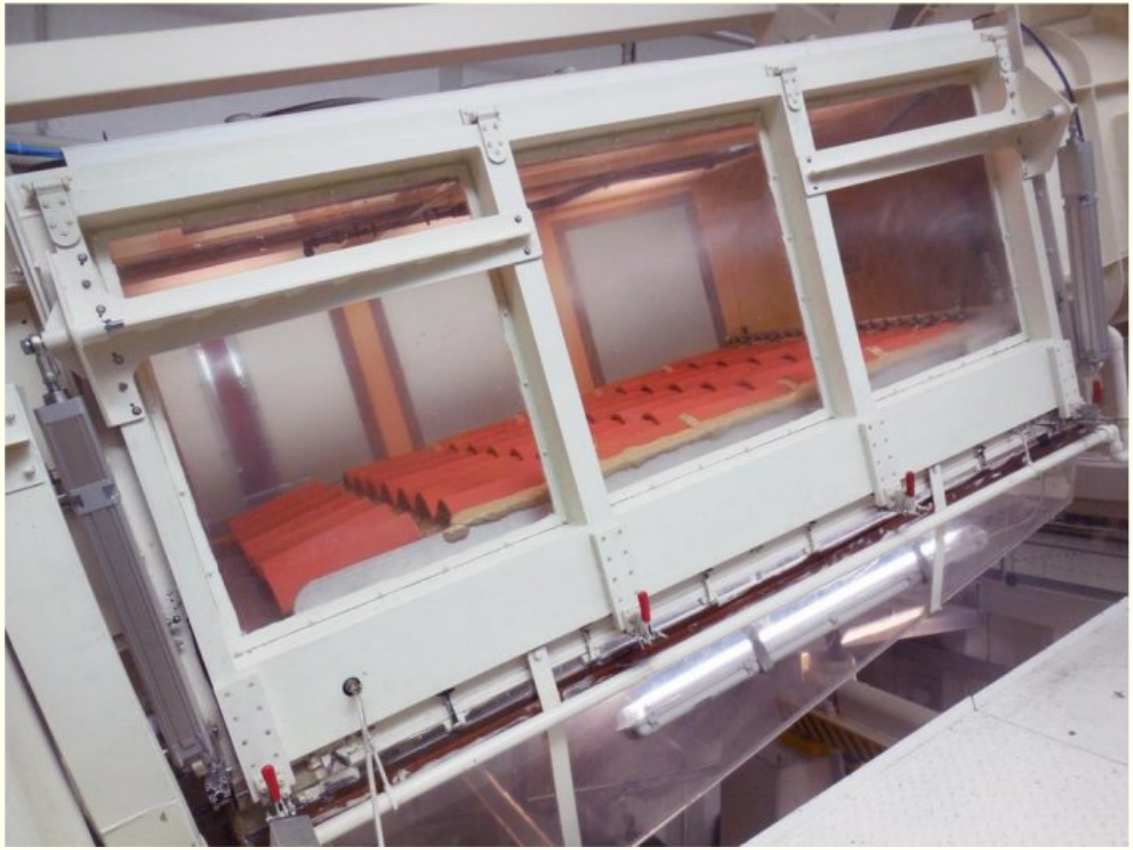
Action 1 – portuguese variation







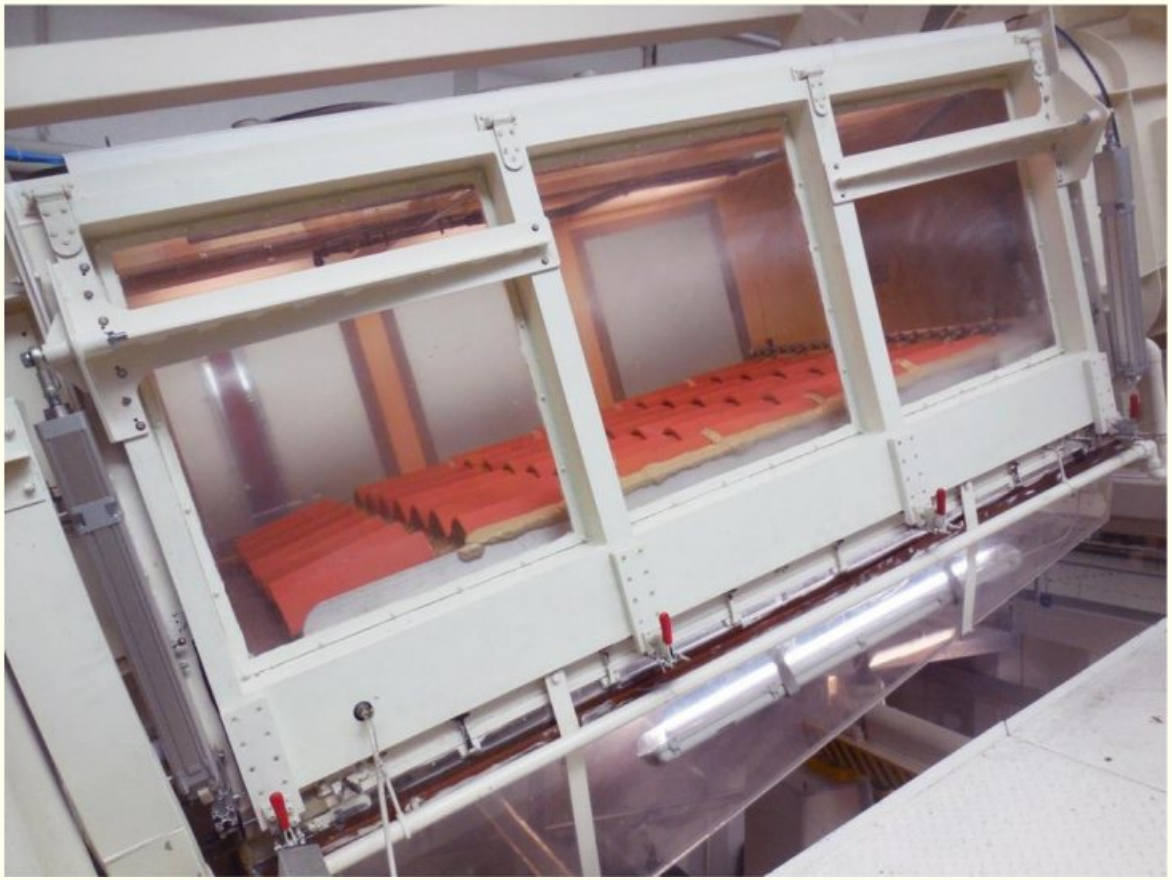
Action 1- PROTOTYPES



Monier Techinical Center
Driving rain wind tunnel

Tested driving rain performance Herotile tiles.

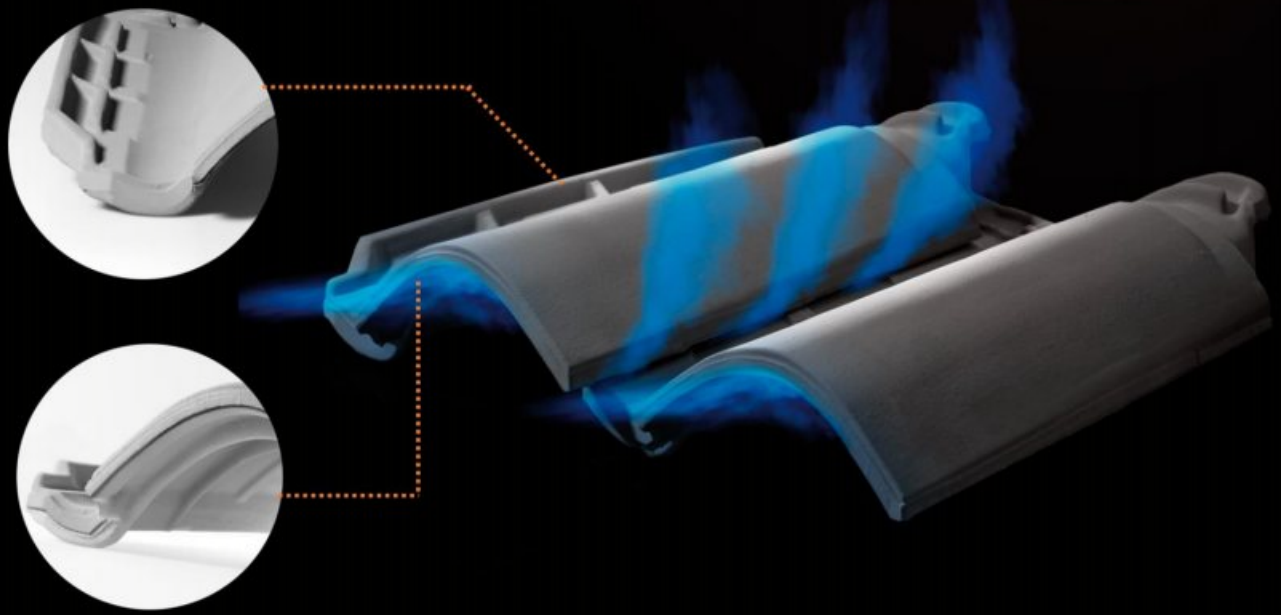
Action 1- PROTOTYPES



Life-Herotile – Action 2

Productive process

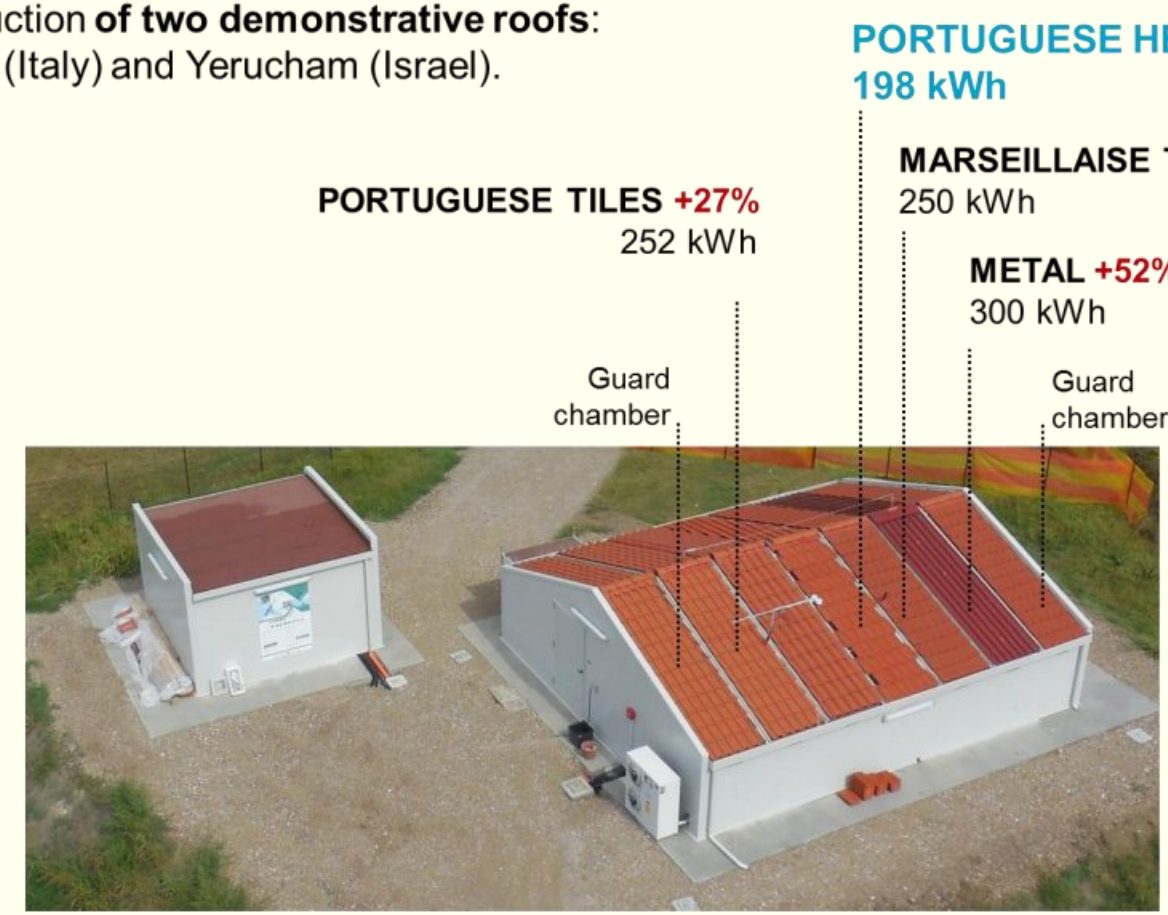
Action 2



The new roof tile, thanks to its innovative shape, augments the above sheating ventilation and energy efficienty of the house.

Life-Herotile – Action 3

Construction **of two demonstrative roofs**:
Ferrara (Italy) and Yerucham (Israel).



REAL SCALE TEST BUILDINGS - FERRARA

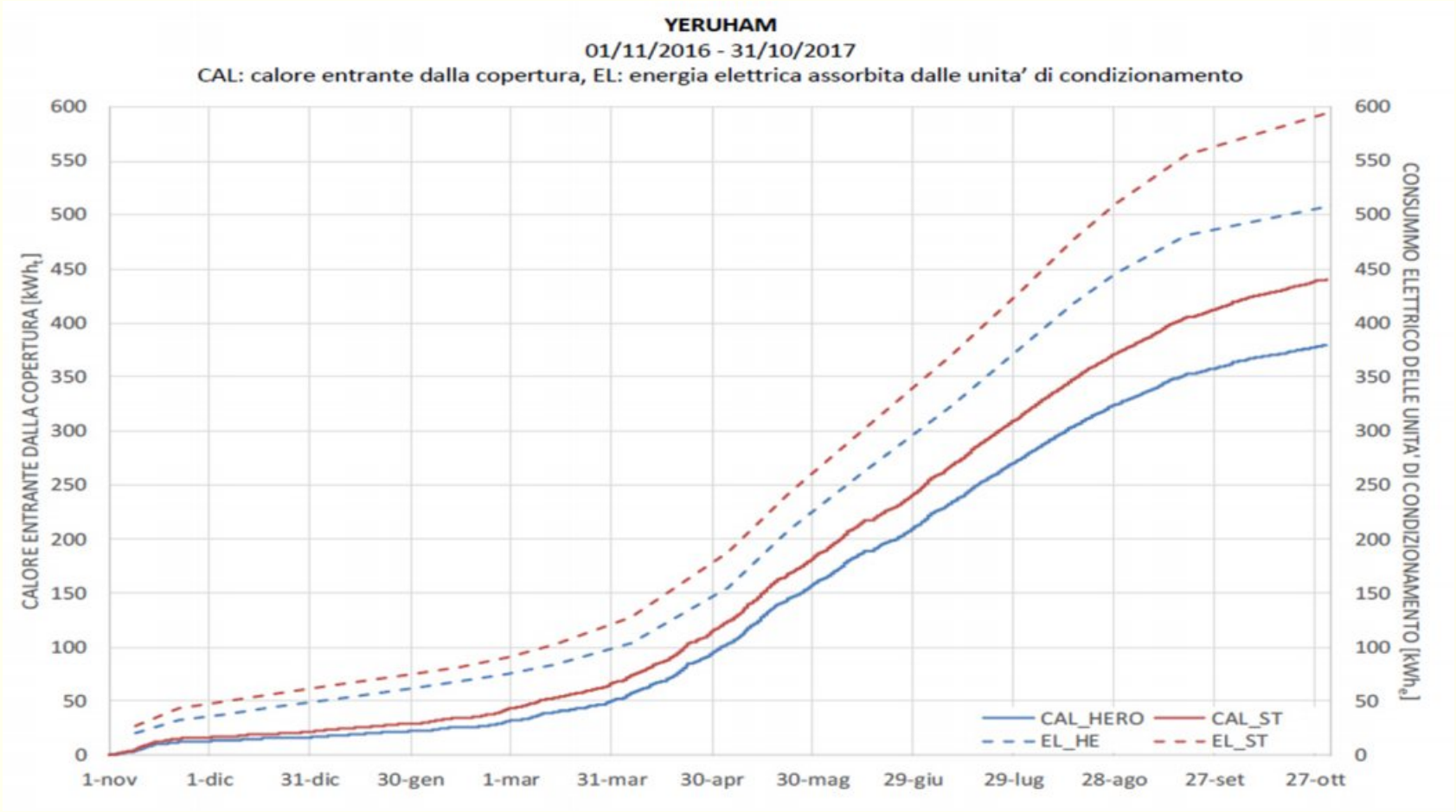
Energy consuption for cooling (to maintain a intern temp. of 25°/26°C)

15/04/2017-14/10/2017

Action 3

Action 3

Room	Type	Roof	kWh / m³
F2	STANDARD Roof tile Portuguese	pitched	9,70 **+21%**
F3	HEROTILE Roof tile Portuguese	pitched	8,00
F5	STANDARD Roof tile Marseille	pitched	9,30 **+16%**
F6	Metal	pitched	14,70 **+85%**
P2	Plane	flat	26,00 **+225%**


YERUHAM
01/11/2016 - 31/10/2017
CAL: calore entrante dalla copertura, EL: energia elettrica assorbita dalle unita' di condizionamento
CALORE ENTRANTE DALLA COPERTURA [kWht]
CONSUMMO ELETTRICO DELLE UNITA' DI CONDIZIONAMENTO [kWhe]
0
50
100
150
200
250
300
350
400
450
500
550
600
1-nov
1-dic
31-dic
30-gen
1-mar
31-mar
30-apr
30-mag
29-giu
29-lug
28-ago
27-set
27-ott
CAL_HERO
CAL_ST
EL_HE
EL_ST

Life-Herotile – Action 4

Verification of the collected data on two real buildings, one in Zaragosa (Spain) and the other in Ca' del Bosco (Italy).

-50%

Reduction of the **inlet watts to be cooled** in comparison with a non-ventilated roof

2.2 Obtained results

The outcome of the LIFE Hero Tile project are:

THE NEW MARSEILLAISE AND PORTUGUESE TILES

characterized by a higher air permeability, able to halve the energy requirement for space cooling from an average value of 30 to 15 kWht/m2.

Portuguese roof tile *Marseillaise roof tile*

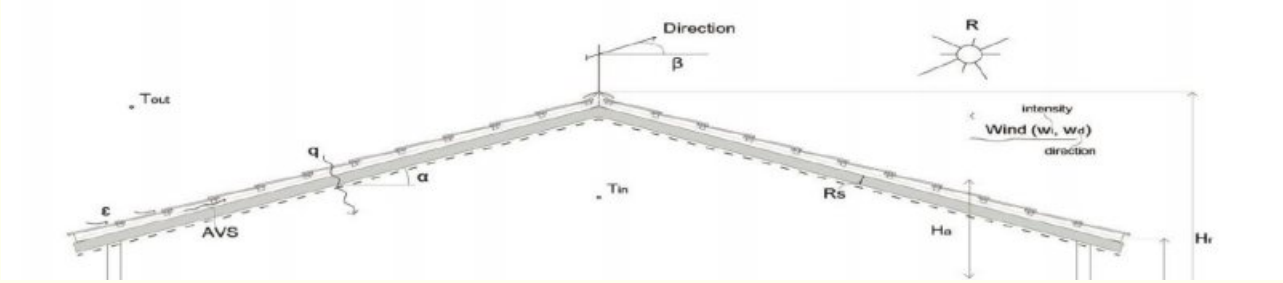
The above table shows an average heat gain reduction of 58.1% by substituting the various existing roofs with the new HEROtile. That allows to consider verified the forecasted value of 50% as reduction of the energy requirement for space cooling from an average value of 15 kWht/m2.

Action 5 – SENSAPIRO

Developing a software to **predict the global energy performance of a pitched roof** covered with Portoghese and Marsigliese HEROTILE in comparison with products already present in the market.

PARAMETERS:

- **Air permeability** (ventilated, micro-ventilated, not ventilated)
- **Pitch slope**
- **Climate zones** (CDD; wind)
- **Roof insulation** (thickness; material)
- **Building energy label**



2.2 Obtained results

SENSAPIRO free-license software

After collect 320.000.000 data a very simple tool to check the energy performance of the same building by changing the roof configuration.

Action 5 – SENSAPIRO *imput data*

- Period: 1st May – 30th September
- Roof made by 6 layers

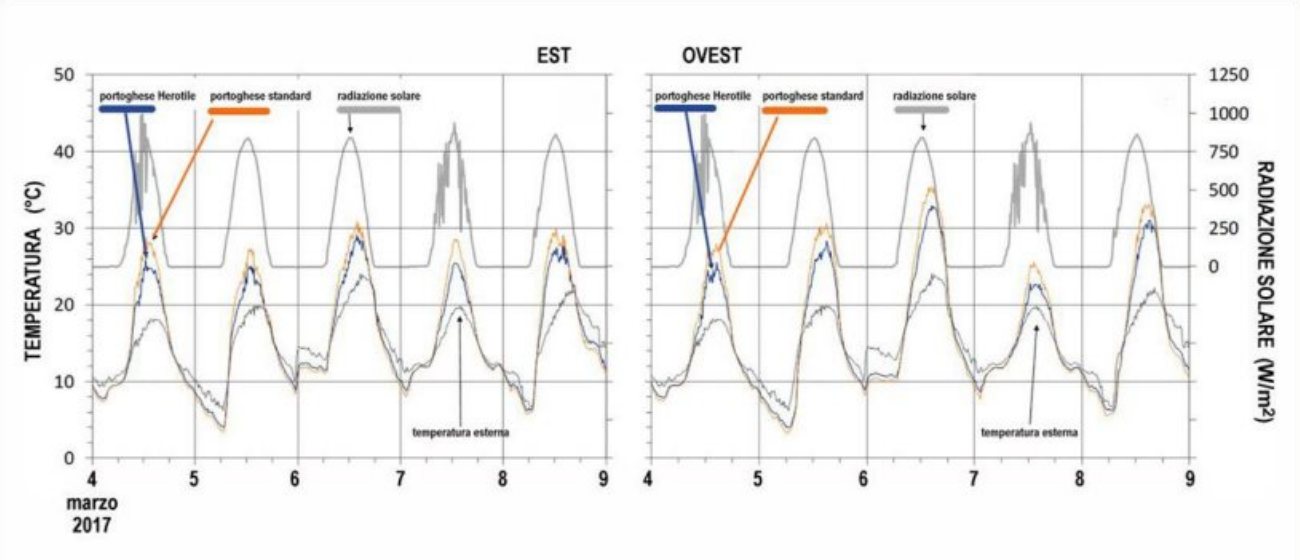
Layers	Thickness (mm)	Thermal conductivity (W/mK)	Density (kg/m3)	Specific heat (J/Kgk)
Plaster	30	0.9	1800	1000
Hollow flooring block	200	0.7	600	840
Low reinforced concrete	40	1.6	2300	1000
Reinforced concrete	40	1.8	2500	1000
Linoleum	1	0.22	670	1400
XPS	60	0.036	30	1200

SENSAPIRO	Existing roof (roof tit of of 20°)			Replaced by HEROtile	HEROTile vs		
	Trad. tile	Metal	Flat		Trad. tile	Metal	Flat
Capitals	Heat gain KWht/m^2				% heat gain reduction		
Tel Aviv	13.1	20.4	35.2	9.7	-26%	-52%	-72.6%
Bucarest	11.1	16.6	26.2	8.1	-27.5%	-51.3%	-69.2%
Atene	14.2	21.4	34.8	10.2	-28.5%	-52.6%	-70.8%
Sofia	7.6	11.7	18.2	5.3	-30.0%	-54.5%	-70.8%
Madrid	8.8	15.9	21.2	5.7	-35.4%	-64.0%	-73.1%
Belgrado	10.2	15.4	24.3	6.6	-35.6%	-57.4%	-73.1%
Roma	10.8	15.8	25.1	6.6	-38.5%	-58.0%	-73.6%
Monaco	7.4	11.6	18.1	4.5	-39.0%	-61.0%	-75.1%
Francoforte	7.0	10.9	17.2	3.9	-45.0%	-64.6%	-77.5%
Parigi	6.9	11.0	16.9	3.7	-46.6%	-66.5%	-78.3%
Bruxelles	6.1	9.4	15.2	3.2	-48.3%	-66.2%	-79.2%
Vienna	7.6	12.0	18.7	2.7	-65.2%	-77.7%	-85.8%
Aver. values	**15.4**			**5.8**	**-38.8%**	**-60.5%**	**-74.9%**
					-58.1%		

2.1 Project activities

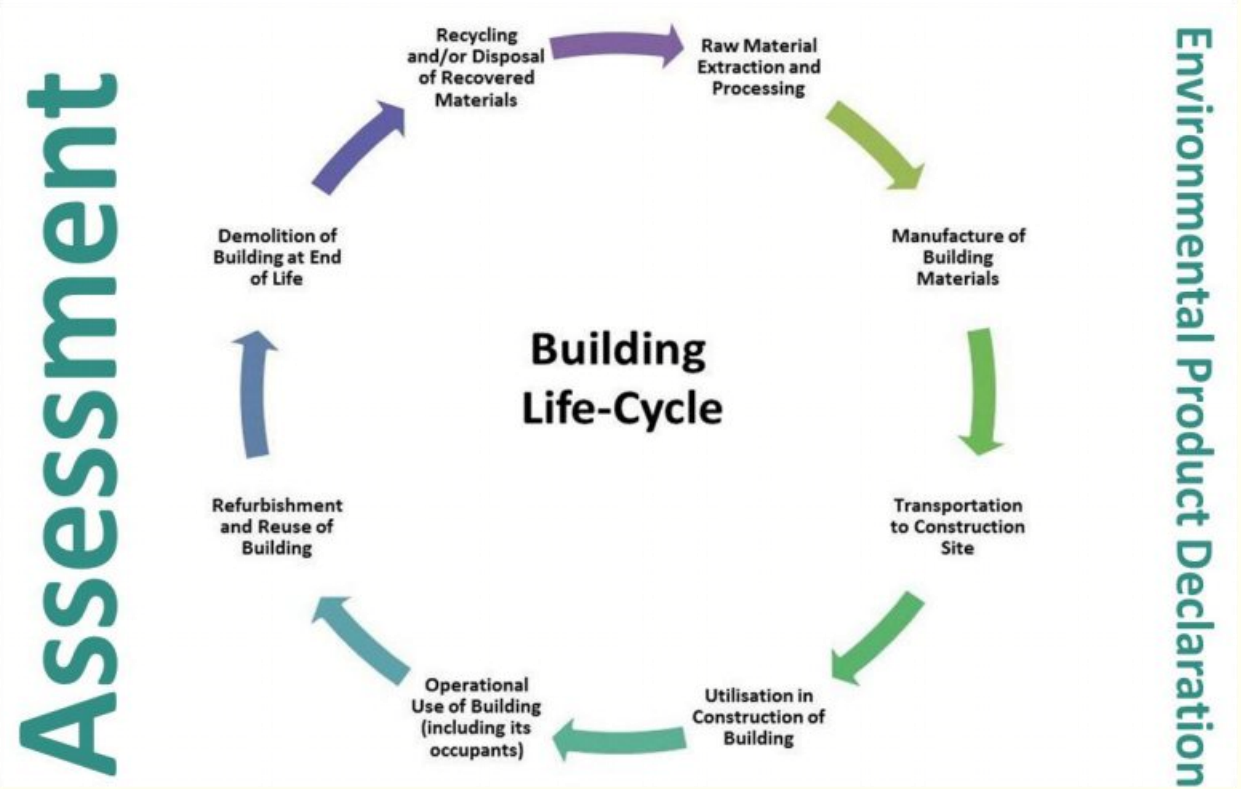
A PRACTICAL AND SIMPLIFIED FREE-LICENSE SOFTWARE

for architects and technicians – SENSAPIRO Software ENergy SAvings PItched Roofs, able to predict the energy performance of the same building in changing only the roof configuration. Testing the new tiles in real environment and real scale on a real-scale demonstrator building has been useful for data validation of the software outcomes for the assessment of energy savings of pitched tiled with the new HEROtiles.



life SUPERHERO

Life Cycle Assessment

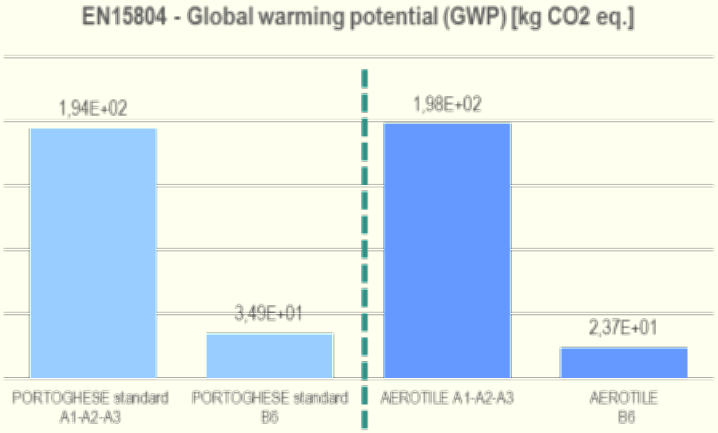


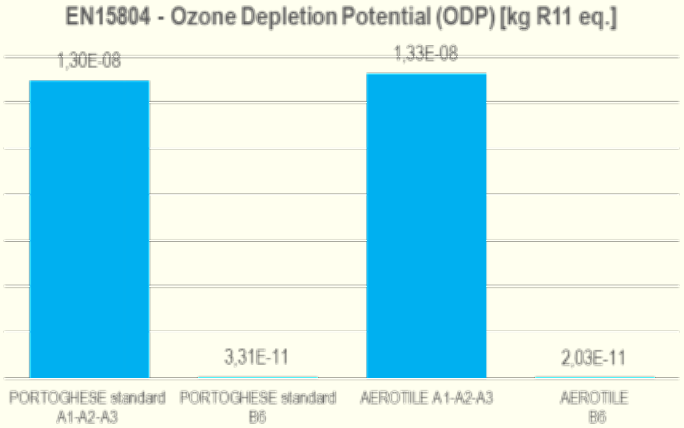
EPD Environmental Product Declaration

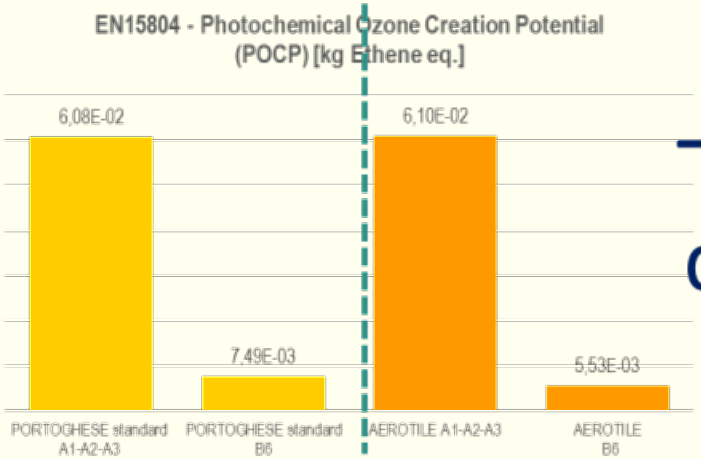
-40% kg CO_2eq.

emitted during production Life Cycle stage

HEROTILE Use stage B6





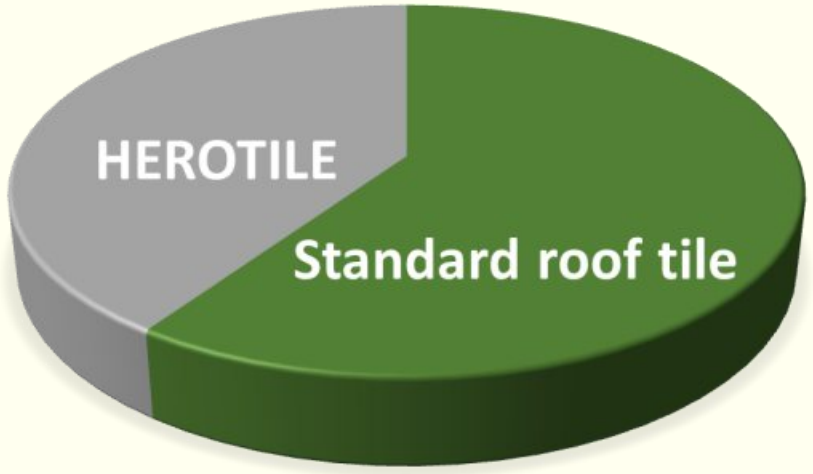


-26% Env. Impact

during 100 years RSL

HEROTILE Use stage B6

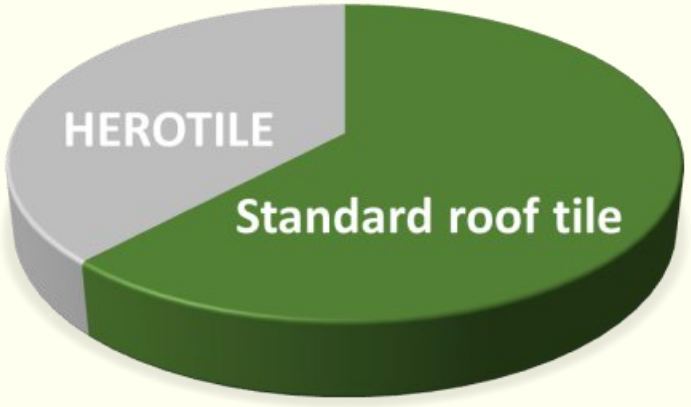
-30% GWP kg $CO_{2\ eq.}$ emissions



Global warming potential

HEROTILE Use stage B6

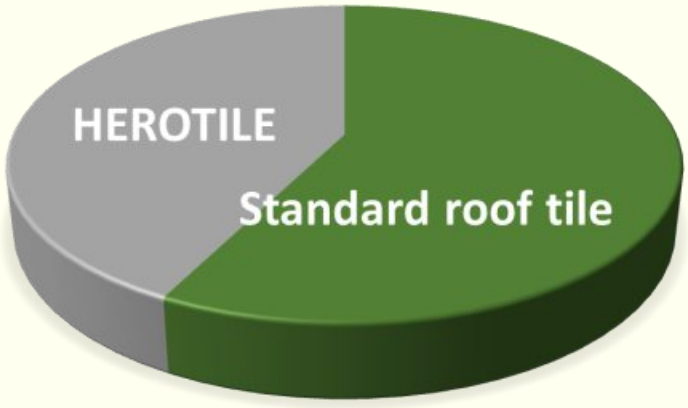
-38% ODP kg $R11_{eq.}$ emissions



Ozone Depletion Potential

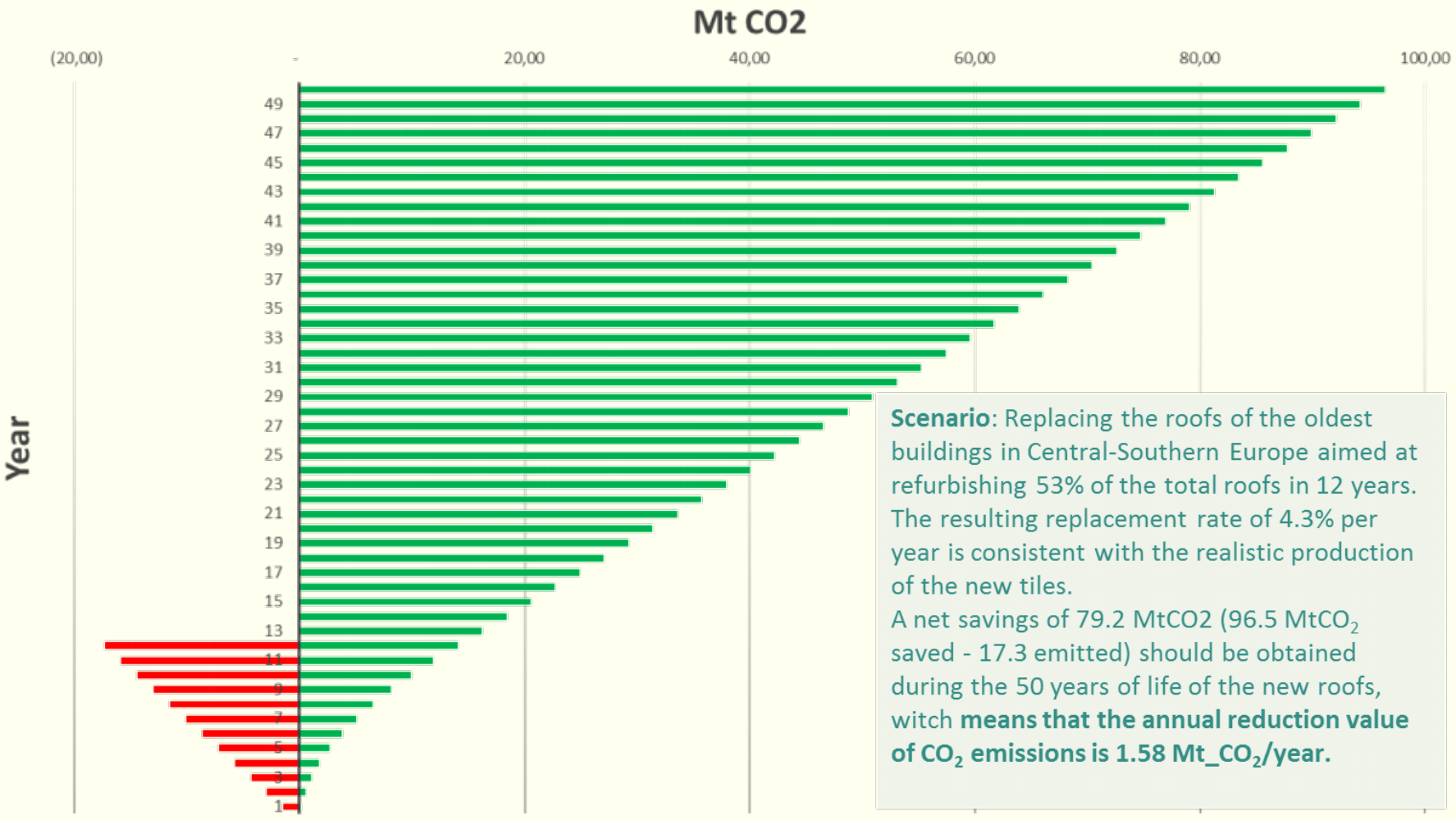
HEROTILE Use stage B6

-26% POCP kg Ethene$_{eq.}$ emissions



Photochemical Ozone Creation Potential

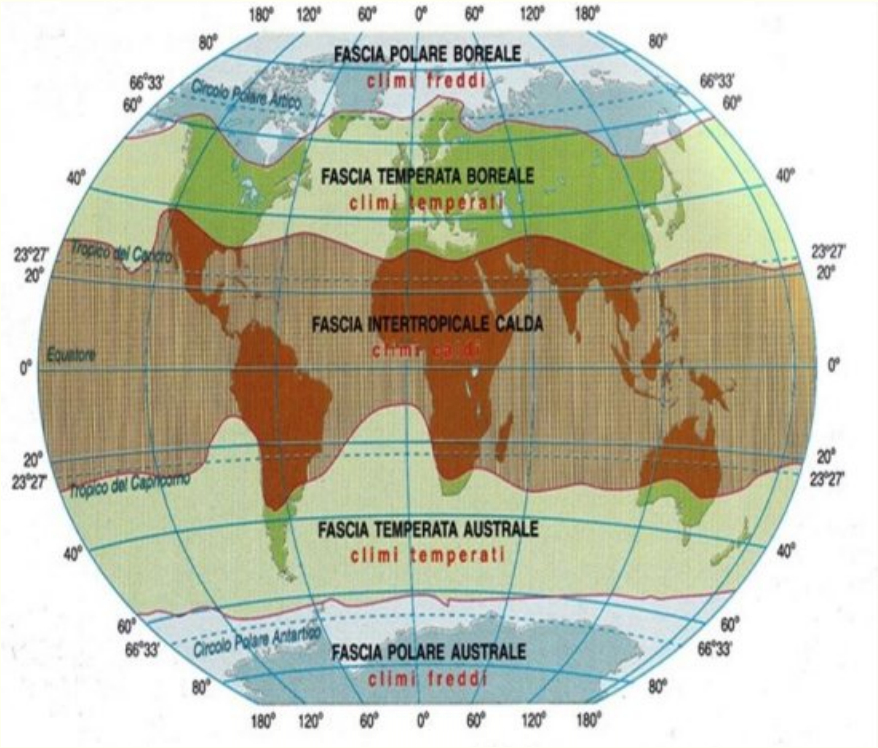
CO2 saved - refurbishment rate 4.3%/Y



Scenario: Replacing the roofs of the oldest buildings in Central-Southern Europe aimed at refurbishing 53% of the total roofs in 12 years. The resulting replacement rate of 4.3% per year is consistent with the realistic production of the new tiles.
A net savings of 79.2 MtCO2 (96.5 $MtCO_2$ saved - 17.3 emitted) should be obtained during the 50 years of life of the new roofs, witch **means that the annual reduction value of CO_2 emissions is 1.58 Mt_CO_2/year.**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Saved	0,	0,	1,	1,	2,	3,	5,	6,	8,	9,	11	14	16	18	20	22	24	27	29	31	33	35	37	40	42	44	46	48	50	53	55	57	59	61	63	66	68	70	72	74	76	79	81	83	85	87	89	92	94	96
Emitted	(1	(2	(4	(5	(7	(8	(1	(1	(1	(1	(1	(1																																								

The CO2 emissions of buildings in the world is constantly and worryingly increasing



- About 6 billion people live in warm and temperate areas.
- Assuming a surface area with a roof of only 100 m2, if 500 million roofs used the new HEROTILE transpiring tiles, it would allow an annual reduction of CO2 emissions to 40 million tons, without taking into account the beneficial effect of reducing the phenomenon island of heat in the cities.

EUROPEAN CLIMATE, INFRASTRUCTURE AND ENVIRONMENT EXECUTIVE AGENCY (CINEA)

CINEA.D - Natural resources, climate, sustainable blue economy and clean energy
D.1 - LIFE Energy + LIFE Climate
Head of Unit

Brussels, 20/01/2022

Mario Cunial
LIFE HEROTILE
Via Molinetto n80,
31054, Possagno (Treviso), Italia

Subject: **LIFE AWARDS 2020**

Dear LIFE HEROTILE team,

More than one year has passed since you were recognised as one of the best 2020 LIFE climate action projects at a very special LIFE Awards Ceremony. A global pandemic prevented you from coming to Brussels in person and we have been thinking about how we could somehow still reward you for your achievements.

We are therefore sending you a small gift as a token of our appreciation to the whole team of the LIFE HEROTILE project.

On behalf of the LIFE community, we congratulate you once again on your commitment to fight climate change in Europe. Thank you for all your efforts and spectacular work.

Wishing you all the very best in your future projects and keep up the good work!

Yours sincerely,

(e-signed)

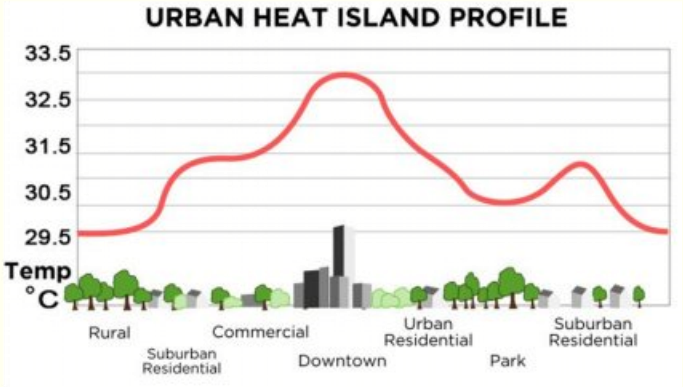
Christian STRASSER

HEROTILE

- reduction of electricity and/or gas consumption necessary to have adequate indoor thermal environment
- reduction of fluorinated gases used for air conditioners
- reduction of the radiative exchanges between external surfaces

BETTER

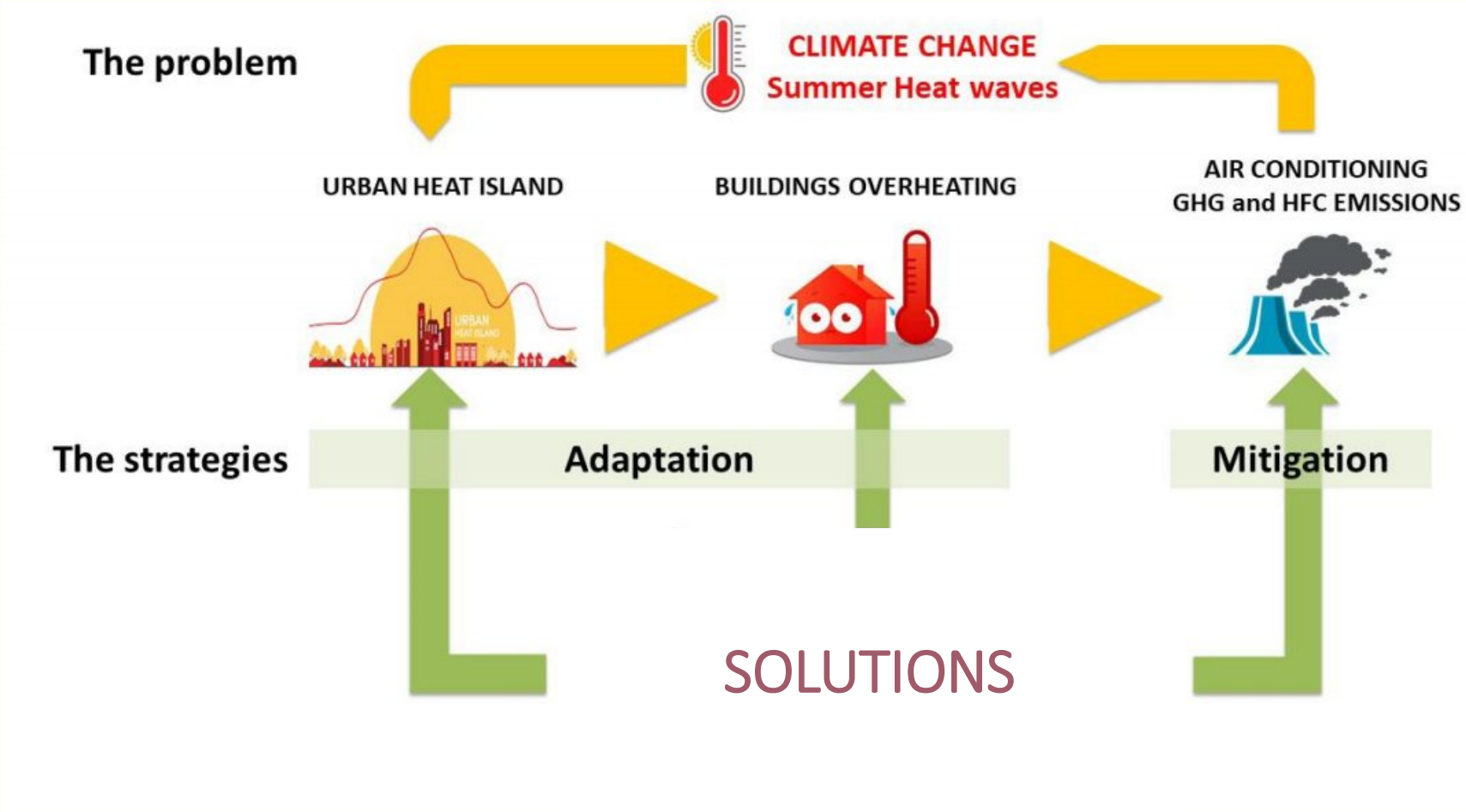
than well known technologies as «cool roofs» suggested, for their reflectivity as the primary action on the roofs to reduce temperature in the inhabited centers (UHI)



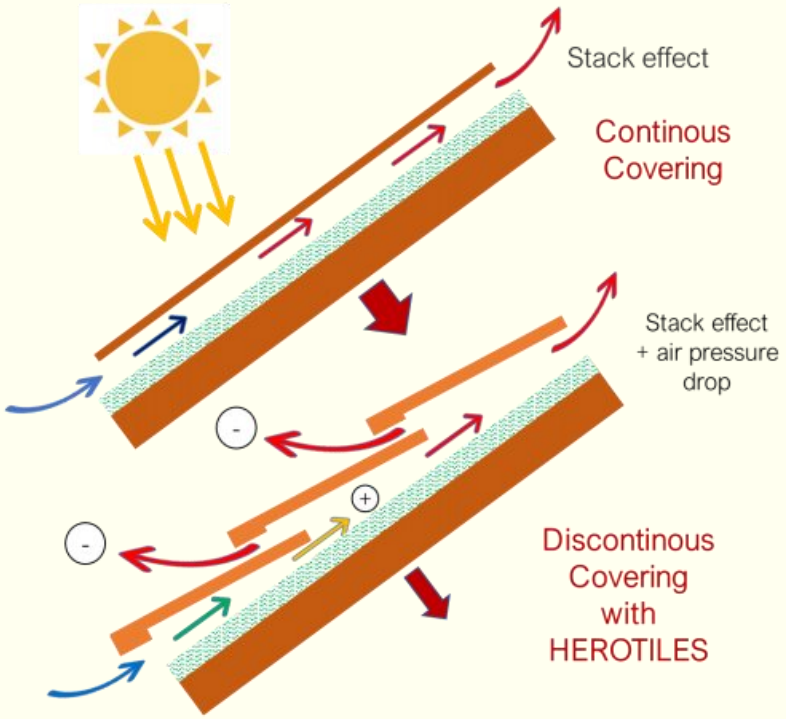
BUT

HEROTILES **are not recognized by UE technical rules and by national energy codes**, because until today there weren't simple physical parameters to describe their behaviour and their effect on the indoor environment and on the climate

THE PROBLEM TARGETED



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. This space reduces heat transfer and allows heat to dissipate from the sheathing and roofing materials.

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.

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

THE CONSORTIUM

LIFE19 CCA/IT/001194

- TOTAL AMOUNT: 3,032,924 €

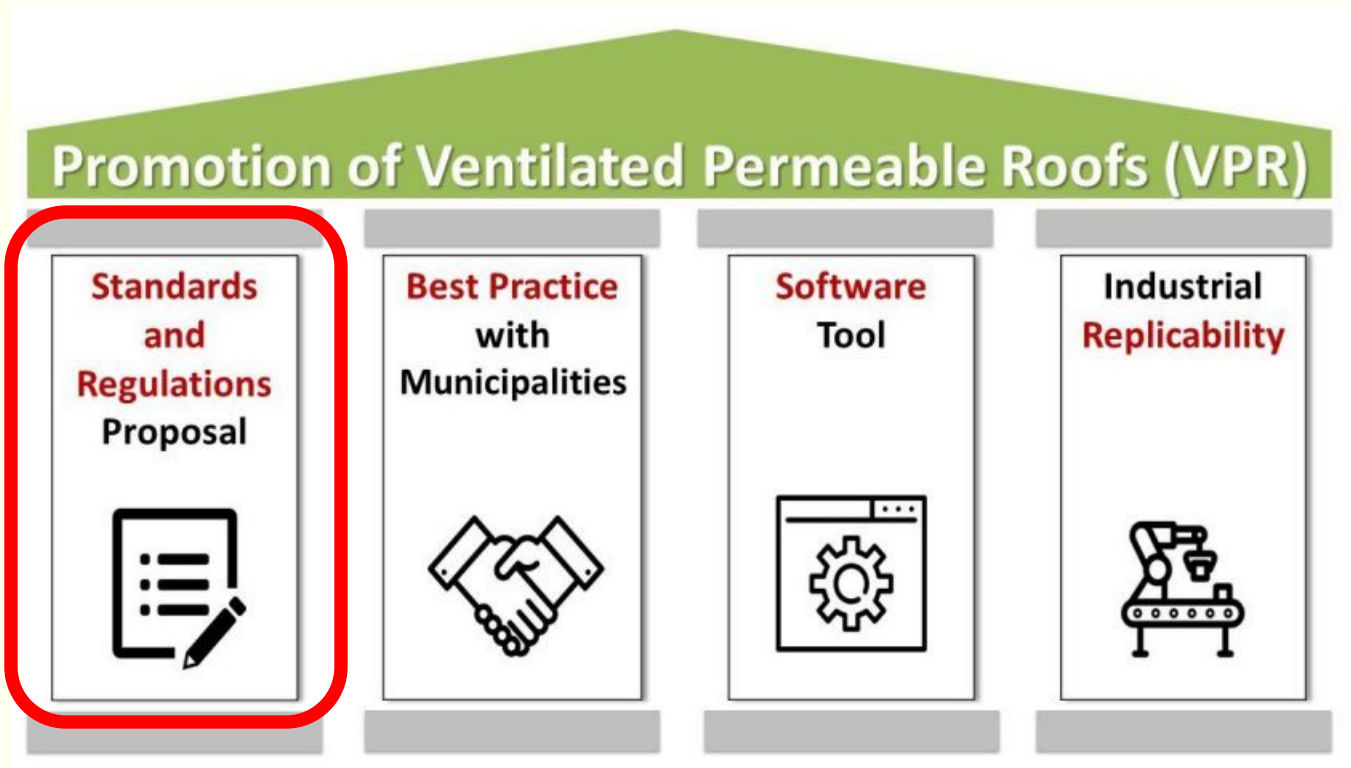
- EU CONTRIBUTION: 1,563,160 € (55%)

- 1/07/2020 - 30/06/2026

OBJECTIVES & SCOPE

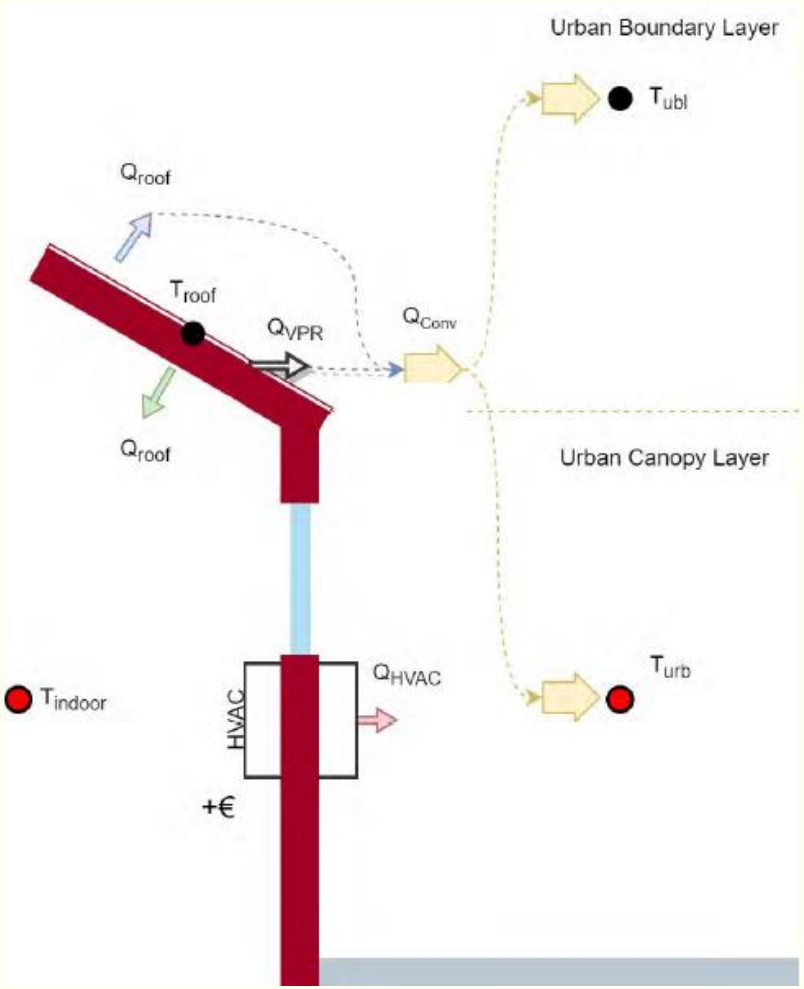
LIFE SUPERHERO is a **Best-Practice project**: it promotes the use of **ventilated permeable roofs** (VPR) as sustainable and cost-effective solutions for building "passive cooling", increasing building occupants' and cities summer comfort (**adaptation**) and decreasing buildings' energy and green-house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

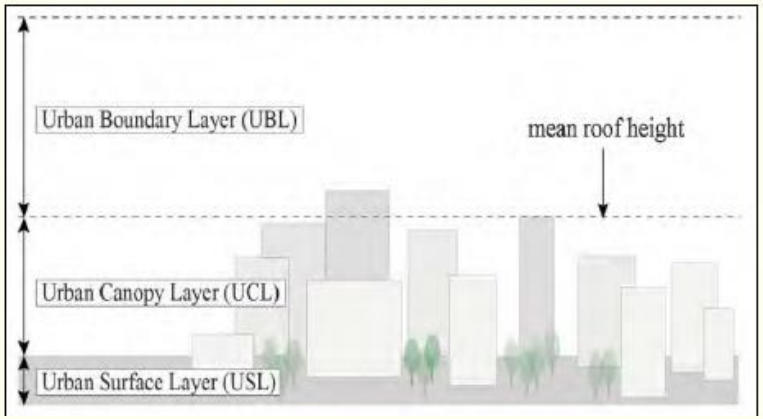
Based on a 4 pillars strategy!



Evaluation of VPR impact on urban climate

- Heat exchange with surrounding air
- Reduction of AC use and the related anthropogenic heat





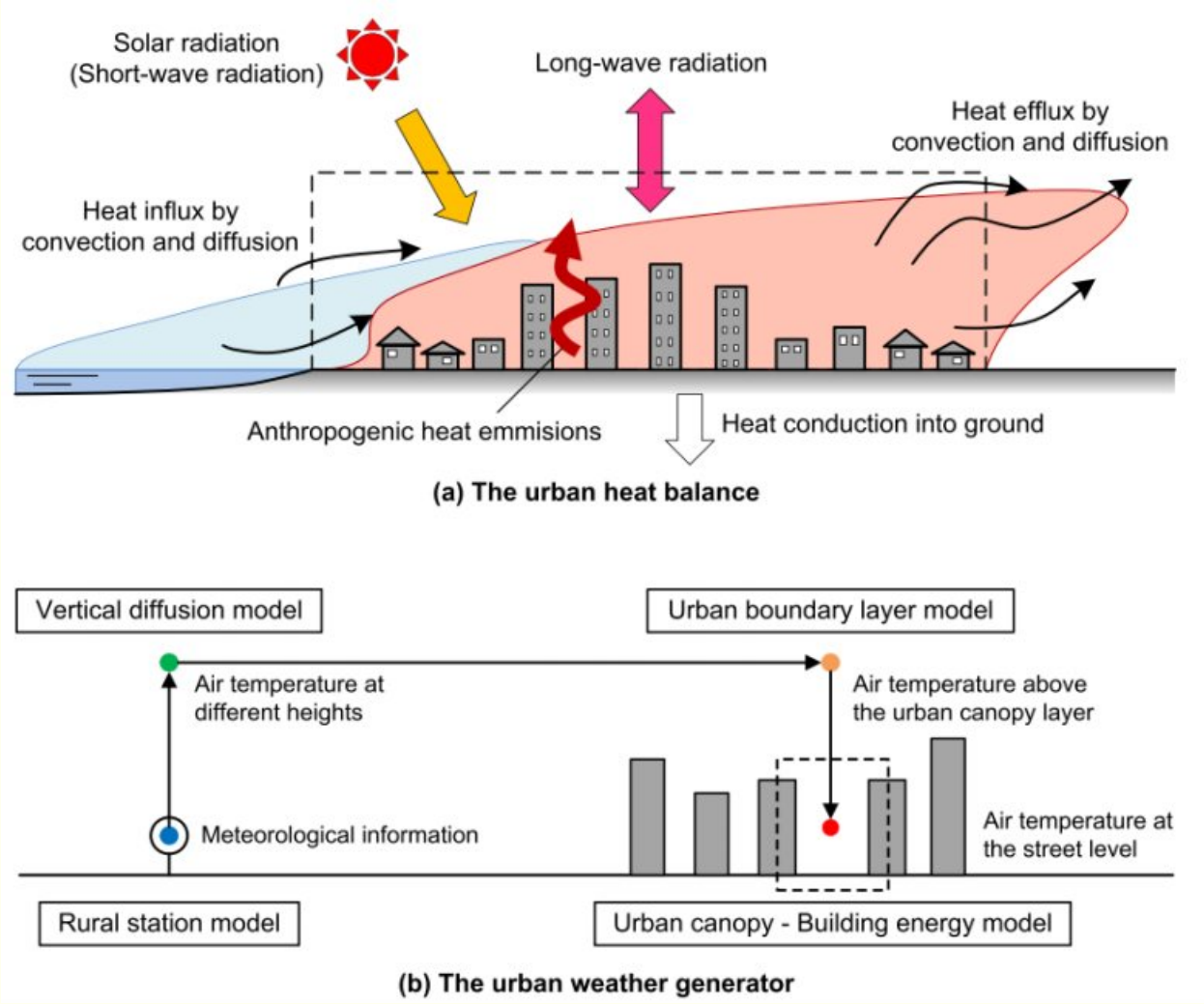
VPR impact on urban climate
Urban Weather Generator - UWG

- Open Source (the code can be modified)

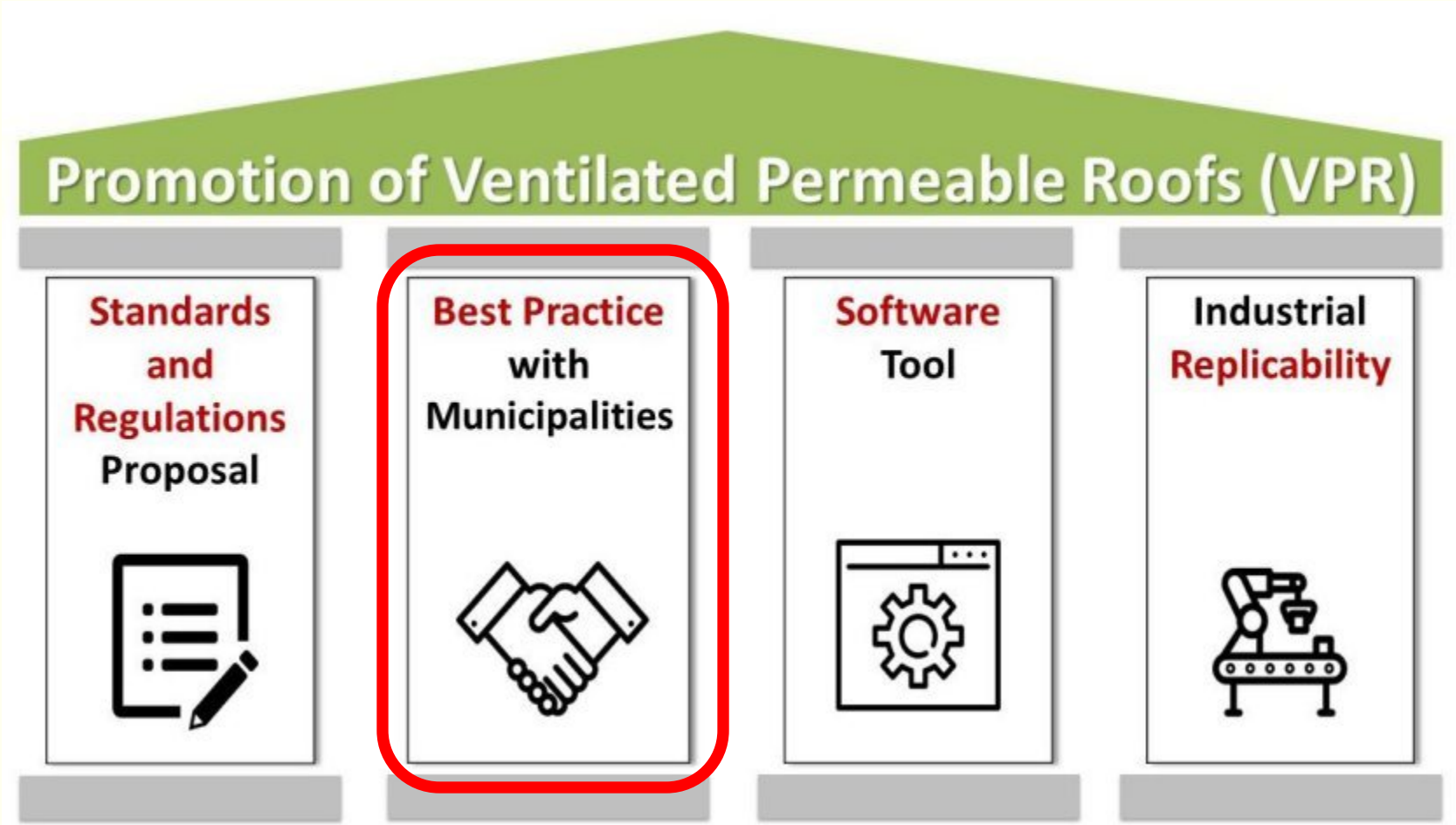
- Explicitly models the Urban Canyon features

- Good balance between accuracy and calculation speed

- Application and validation examples in the literature



Promotion of VPR: main actions



Best-practice for VPR-HBR
The demonstrator buildings

HEROTILES Marseillaise

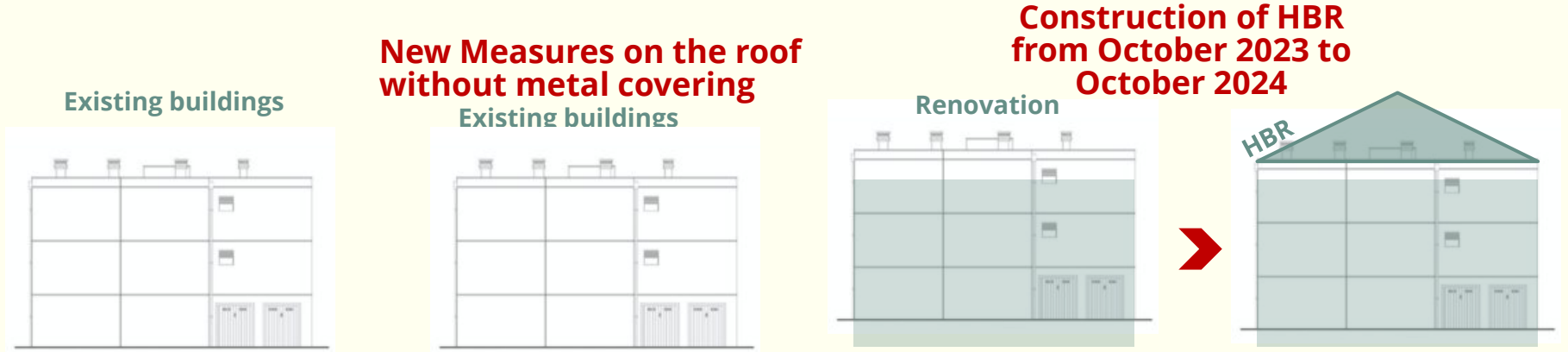
HEROTILES Portuguese

Best-practice for HBR: demonstrator renovation

Current Renovation schedule

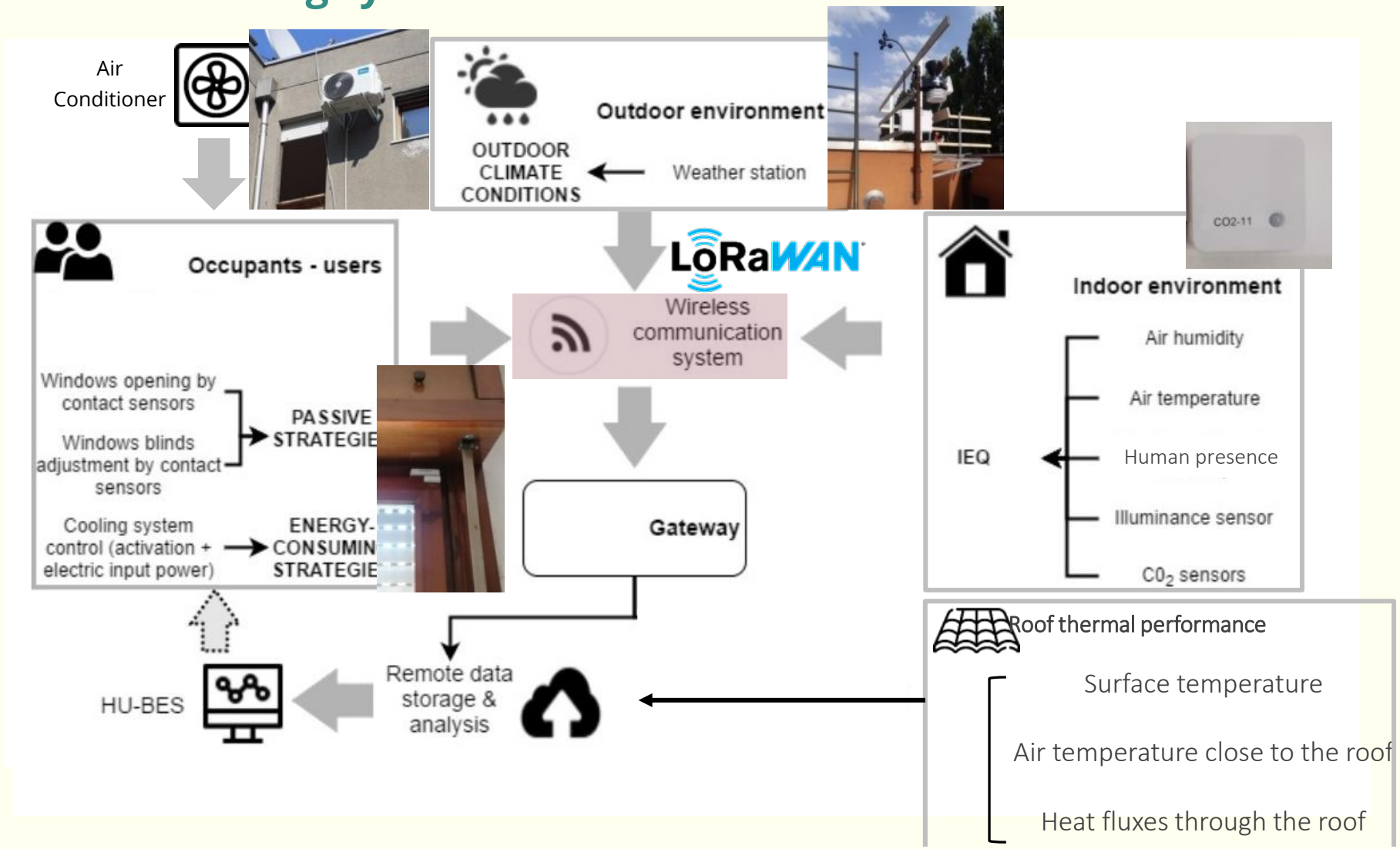
- Extra summer monitoring (2022) on existing buildings and new measures on the roof without metal covering (to define the baseline)
- Monitoring on completed renovation on summer 2024

2021	2022	2023	2024
Existing buildings	Existing buildings	Renovated buildings	Buildings with new HBR



Best-practice for HBR: The monitoring system

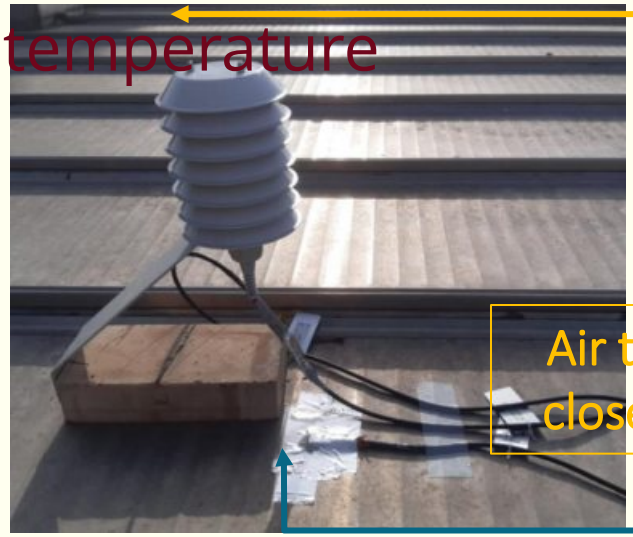
The monitoring system installation



Best-practice for HBR: The monitoring system

The monitoring system installation *(actual roof 2021)*

Surface/air temperature



Heat flux probe

Surface temperatur

Air temperature close to the roof

Surface temperature

OUTDOOR

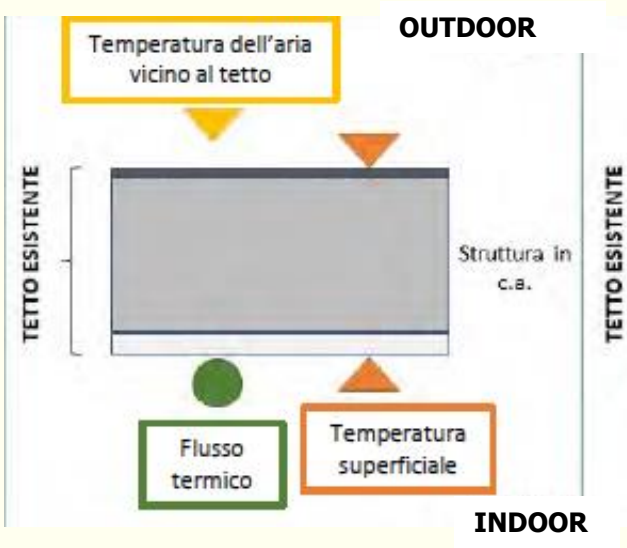
EXISTING ROOF
Slab of reinforced concrete

INDOOR

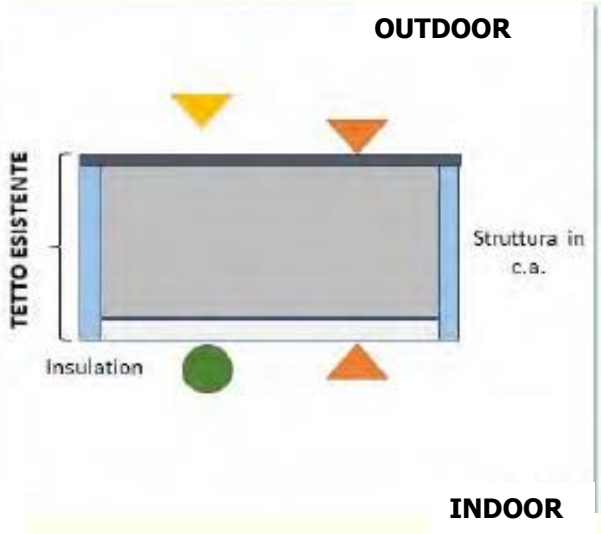
Surface temperature

Heat flux through the roof

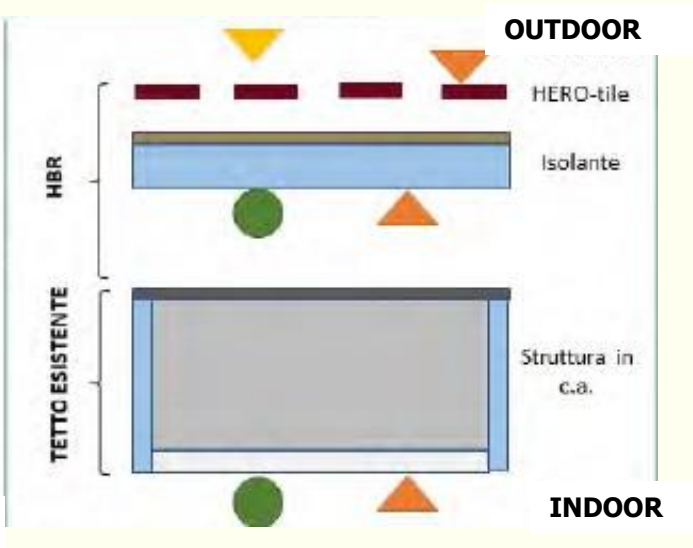
Best-practice for HBR: The monitoring system



Monitoring before renovation



Monitoring after vertical envelope renovation



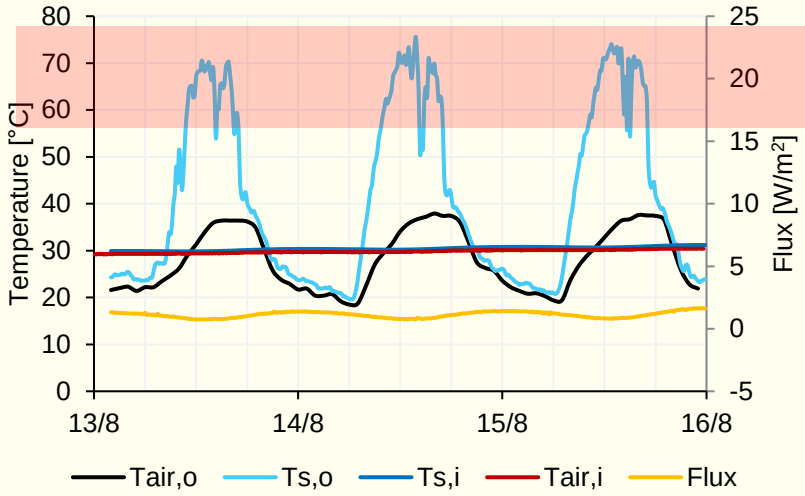
Final Monitoring of the building with VPR-HBR

Best-practice for HBR: Preliminary measurements results

The roof

Not occupied flat (#25 C)

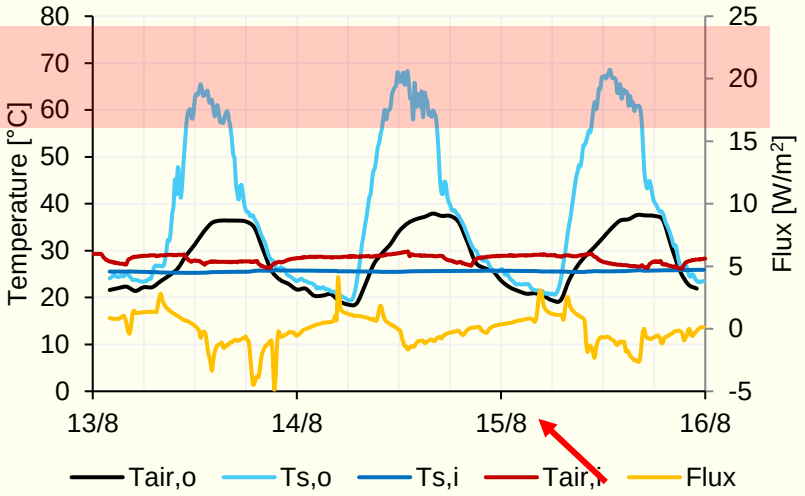
Closed west-facing windows, trees shielding, no conditioning system



- High outdoor surface temperature
- High thermal inertia
- Very low thermal heat fluxes
- Very high constant indoor air temperature (30°C)

Occupied flat (#25 B)

Est-facing windows, trees shielding

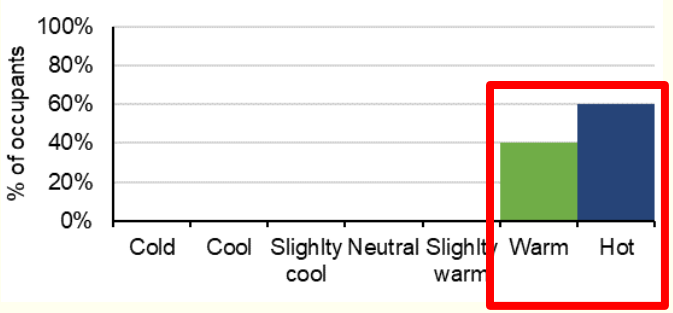


- High outdoor surface temperature
- High thermal inertia
- Very low thermal heat fluxes
- Irregular oscillation of the indoor air temperature (23 – 28°C) due to the AC system

Best-practice for HBR: The questionnaire

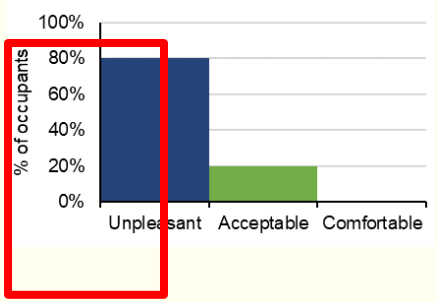
The occupants' survey

Thermal Sensation Vote



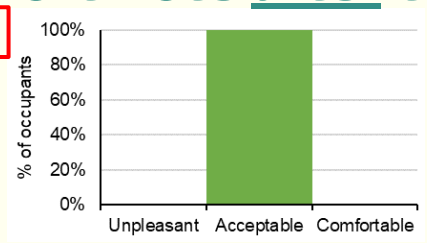
→ General thermal discomfort

Thermal Comfort Vote before the AC installation



→ Unpleasant thermal environment

Thermal Comfort Vote after the AC installation



→ Acceptable thermal environment

Benefits of clay tiles VPR

Among building passive cooling solutions, the use of **ventilated and permeable roofs** is an **efficient** and **sustainable** strategy:

- For the reduction of external roof covering temperature → UHI
- For the reduction of internal temperature and incoming heat fluxes → cooling energy

as demonstrated by LIFE HEROTILE

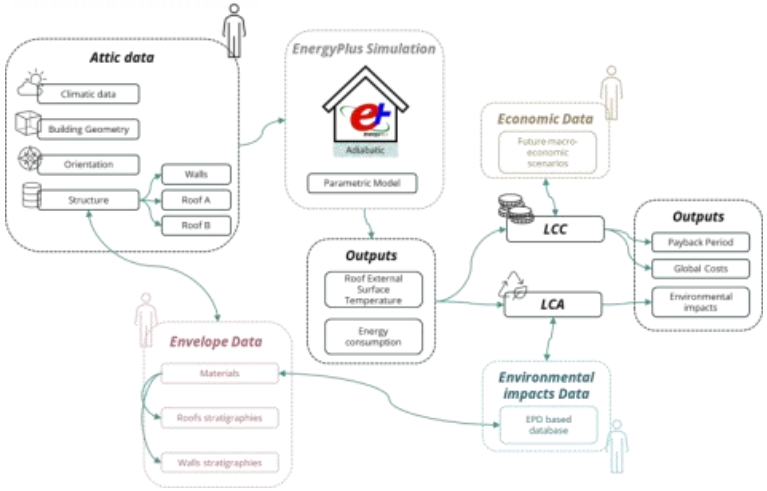
This is obtained trough **low cost , low maintenance durable and sustainable materials**

LIFE SUPERHERO

Software Tool

Sviluppo di un software life superhero

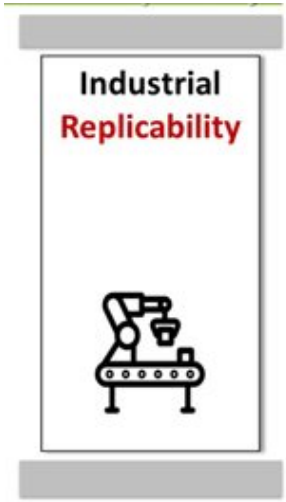
To evaluate the environmental and economic benefits of the life cycle of VPR and HBR compared to other solutions, to support the decisions of professionals and PA



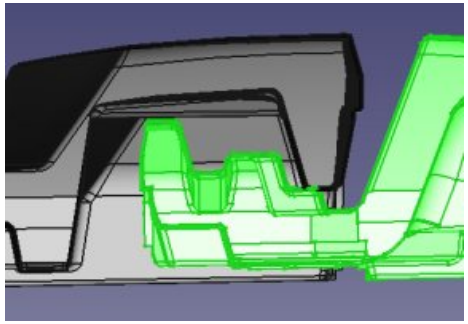
New project LIFE SUPERHERO

Replicabilità e trasferibilità industriale

To promote the market penetration of VPR and HBR, amplifying the impacts of the project, and involving industries and producer associations



Definition of 3D models of two new tiles based on the technical characteristics of the “HEROTILE” tiles



Prototyping, mold making and pilot production

CLAY ROOF TILES

Ancient tradition for a natural product

- Natural
- Long-lasting durability
- Re-usable
- Re-cyclable

life SUPERHERO

Life

Thank You!

www.lifesuperhero.eu

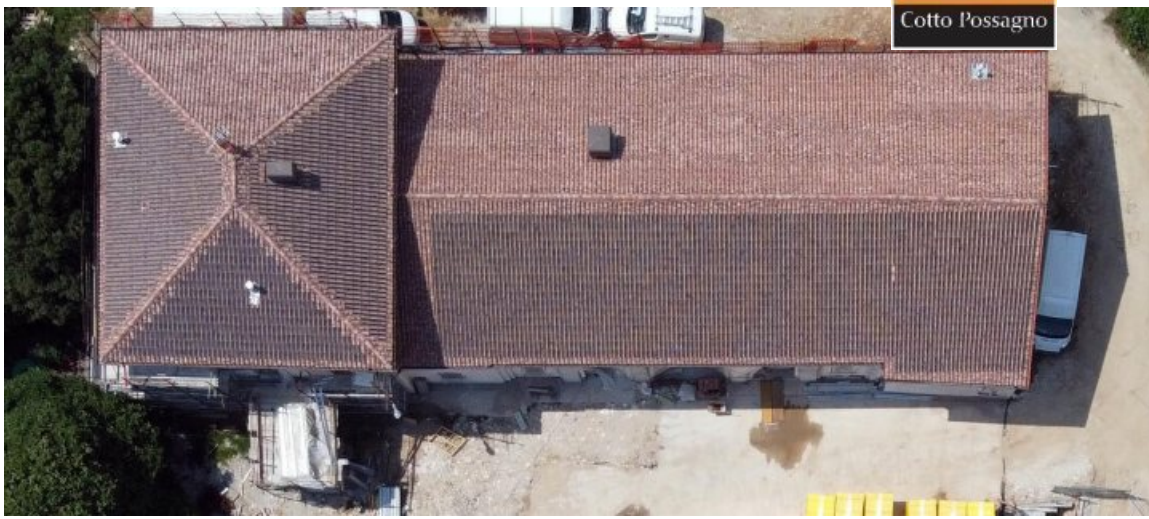
@LifeHerotile

@lifesuperhero

Life Superhero

15,4 Kwp E-coppo
Antique mix

XV-century historical Villa



65,4 Kwp marsigliese red


Industrie
Cotto Possagno


Industrie
Cotto Possagno