

# LIFE Program HeroTile project



Giovanni Zannoni



Università  
degli Studi  
di Ferrara

DA

Dipartimento  
Architettura  
Ferrara

L'efficacia della ventilazione dei tetti a falda con  
la nuova tegola 



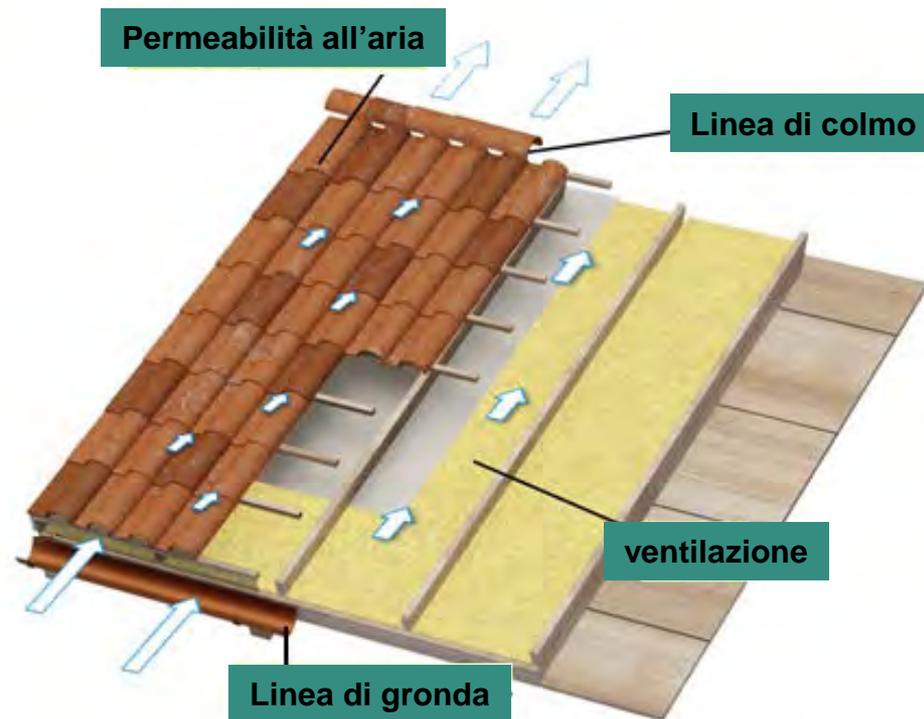
Università  
degli Studi  
di Ferrara



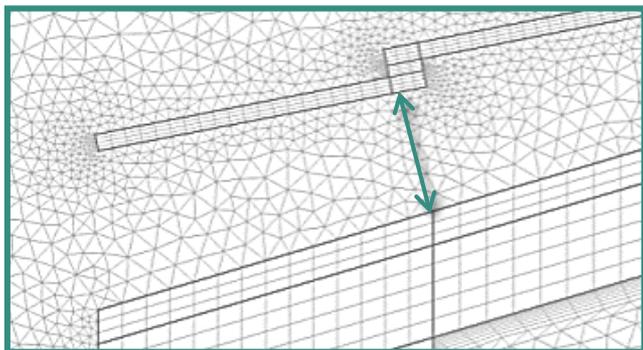
Nei tetti ventilati l'aria entra dalla linea di gronda ed esce dalla linea di colmo.

Questa circolazione d'aria smaltisce una parte del calore solare che riscalda il sottotetto e riduce i consumi per il raffrescamento.

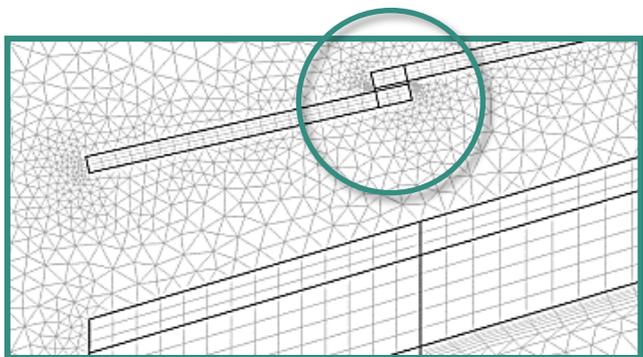
Aumentare la permeabilità all'aria fra le tegole migliora questa prestazione



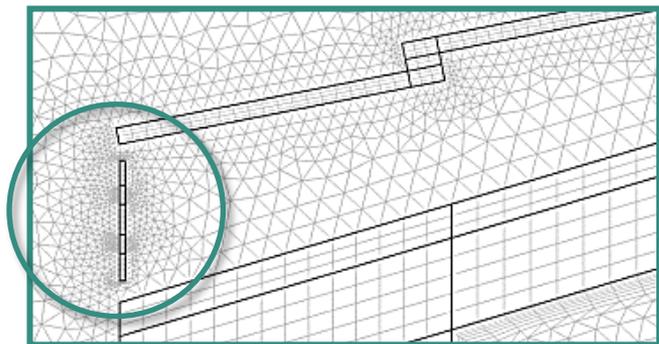
# Simulazioni al computer



**Strato di ventilazione  
4/8 cm**



**Permeabilità  
all'aria  
0.0/2.5/9.0 mm**



**Apertura in  
gronda  
0-50-100%**

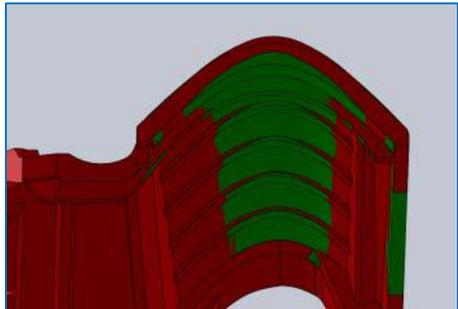
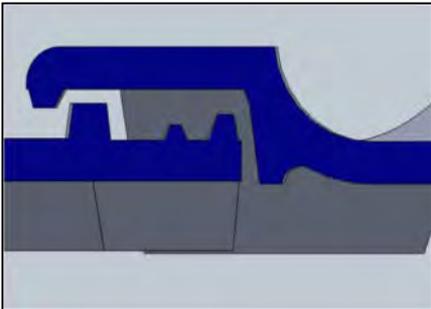
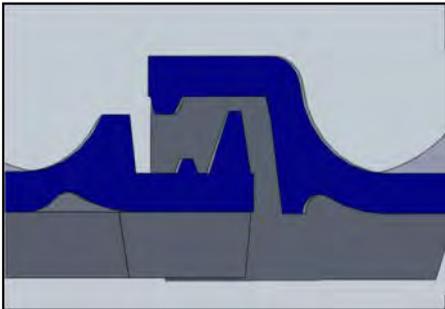
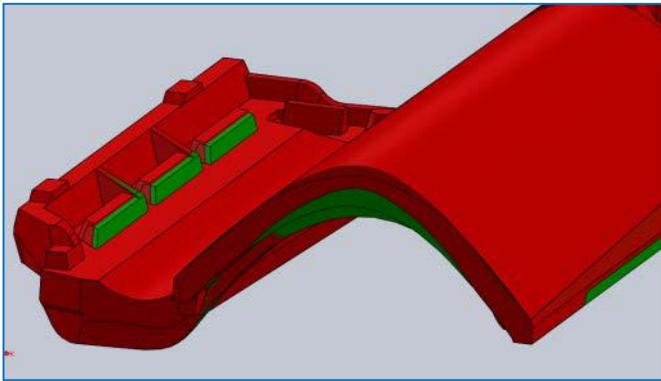
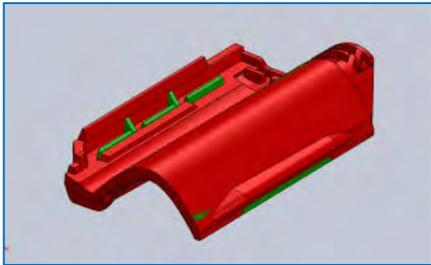
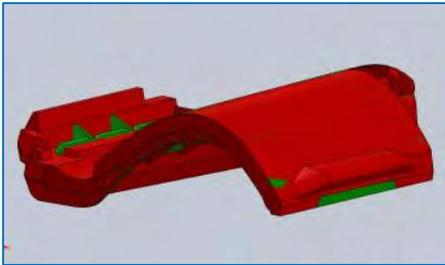




**Obiettivo del progetto HEROTile è stato:**

- **Riprogettare il design delle tegole**
- **Confrontarne le prestazioni con le tegole standard**
- **Selezionare la migliore soluzione e produrla**
- **Verificare le prestazioni con test al vero**

# 24 soluzioni individuate e testate di tegola portoghese e marsigliese



# Matrice di valutazione

Parameter	Case_01n	Case_02n	Case_03n	Case_04n	Case_05n	Case_06m	Case_07m	Case_08mb	Case_09m	Case_10m
Air permeability	1.77	2.17	1.51	1.92	1.73	1.36	1.33	1.58	1.81	1.31
Waterproof	-1.00	-0.36	-0.07	0.14	-0.54	-0.54	-0.79	-1.00	-1.00	-0.79
Conformity of standard regulation	0.00	0.00	-0.21	-0.48	-0.48	0.00	-0.48	0.00	0.00	0.00
Aesthetic index	0.00	-0.48	-0.33	-0.15	-1.00	-0.33	-0.33	0.00	-0.37	0.33
Line production cost	-0.46	-0.64	-0.64	-1.00	-1.00	0.00	-0.46	0.00	0.00	0.00
Unitary cost	-0.13	-0.13	-0.35	-0.35	-1.00	0.00	-0.13	0.00	0.00	0.00
Mechanical performance	-0.44	-0.44	-0.44	-0.44	-1.00	0.00	-0.20	0.00	0.00	0.00
Installation cost	-0.23	-0.23	-0.46	-0.46	-0.77	0.00	-0.54	0.00	-0.23	0.00
Commercial index	0.00	0.29	0.21	0.46	-0.82	-0.07	0.11	0.21	-0.25	0.46
	0.28	0.57	0.17	0.30	-2.24	0.56	-0.32	0.49	0.37	0.48



# Galleria del vento



# prototipazione



## portoghese Herotile



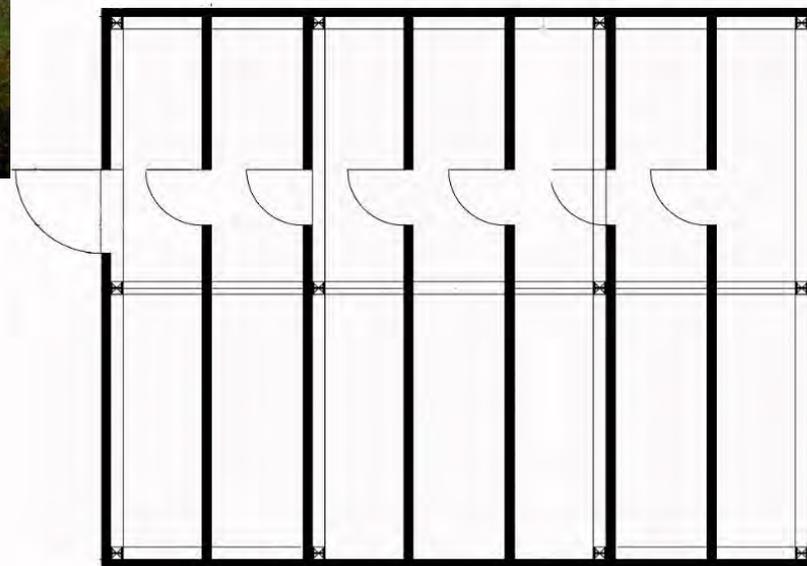
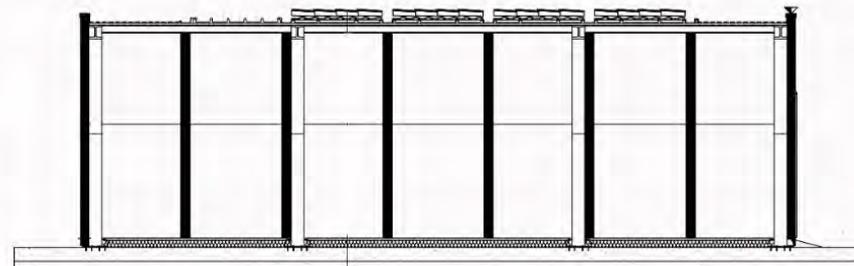
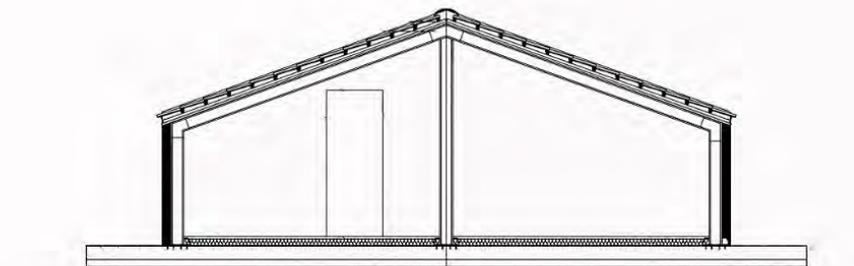
## marsigliese Herotile





## Università di Ferrara Tecnopolo Mock up con tetto a sette falde

- Marsigliese standard
- Marsigliese Herotile
- Portoghese standard
- Portoghese herotile
- Metallo
- 2 camere di guardia





## Università di Ferrara Tecnopolo CAI factory Israele

**Mock up con tetto piano**

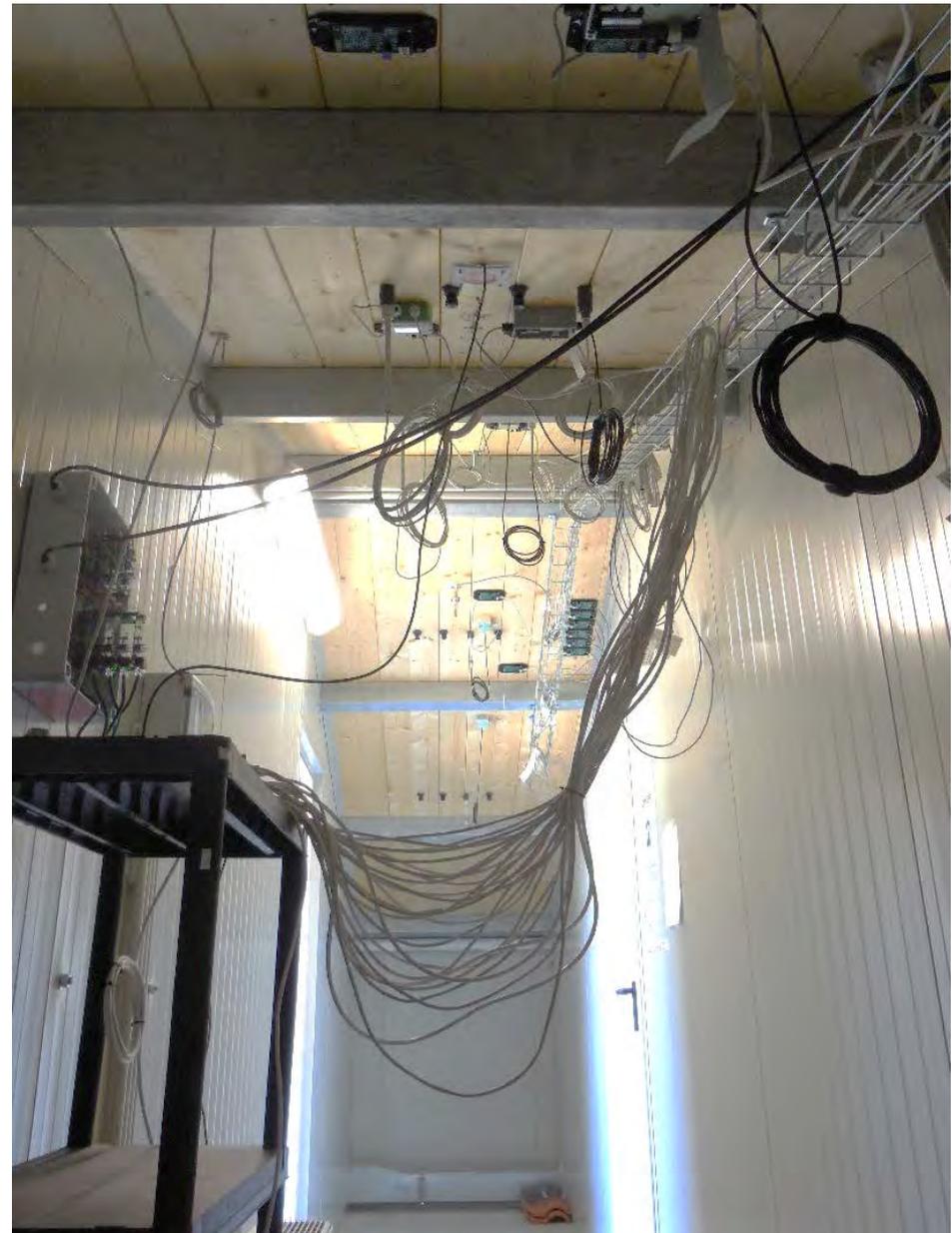
**Mock up con tetto a sette falde**

- Marsigliese standard
- Marsigliese Herotile
- Portoghese standard
- Portoghese herotile
- Metallo
- 2 camere di guardia





## Strumentazione di monitoraggio





## Sperimentazione al vero

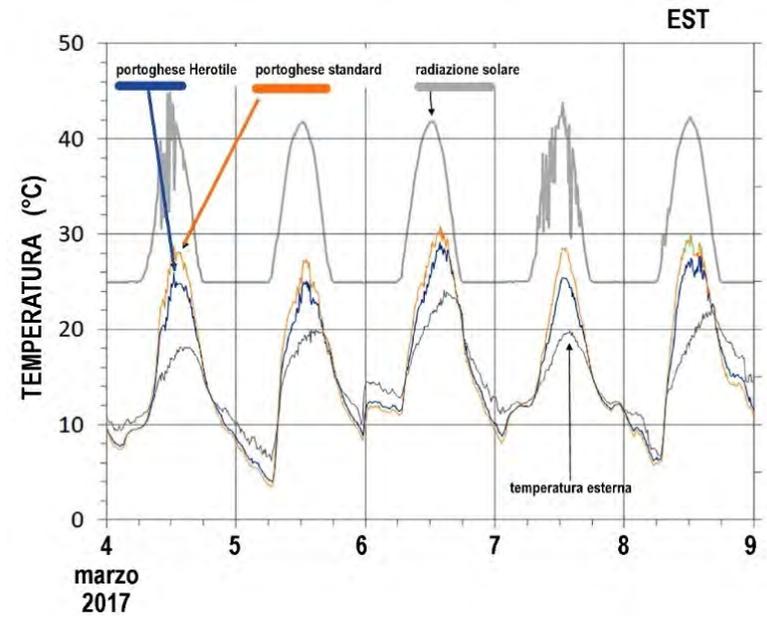
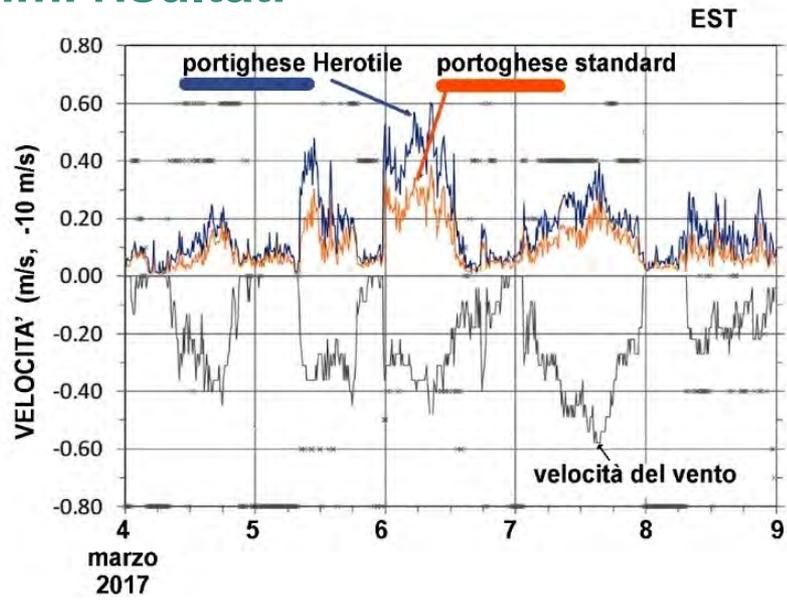
- 2 edifici
- 4 appartamenti

**Saragozza, Spagna**

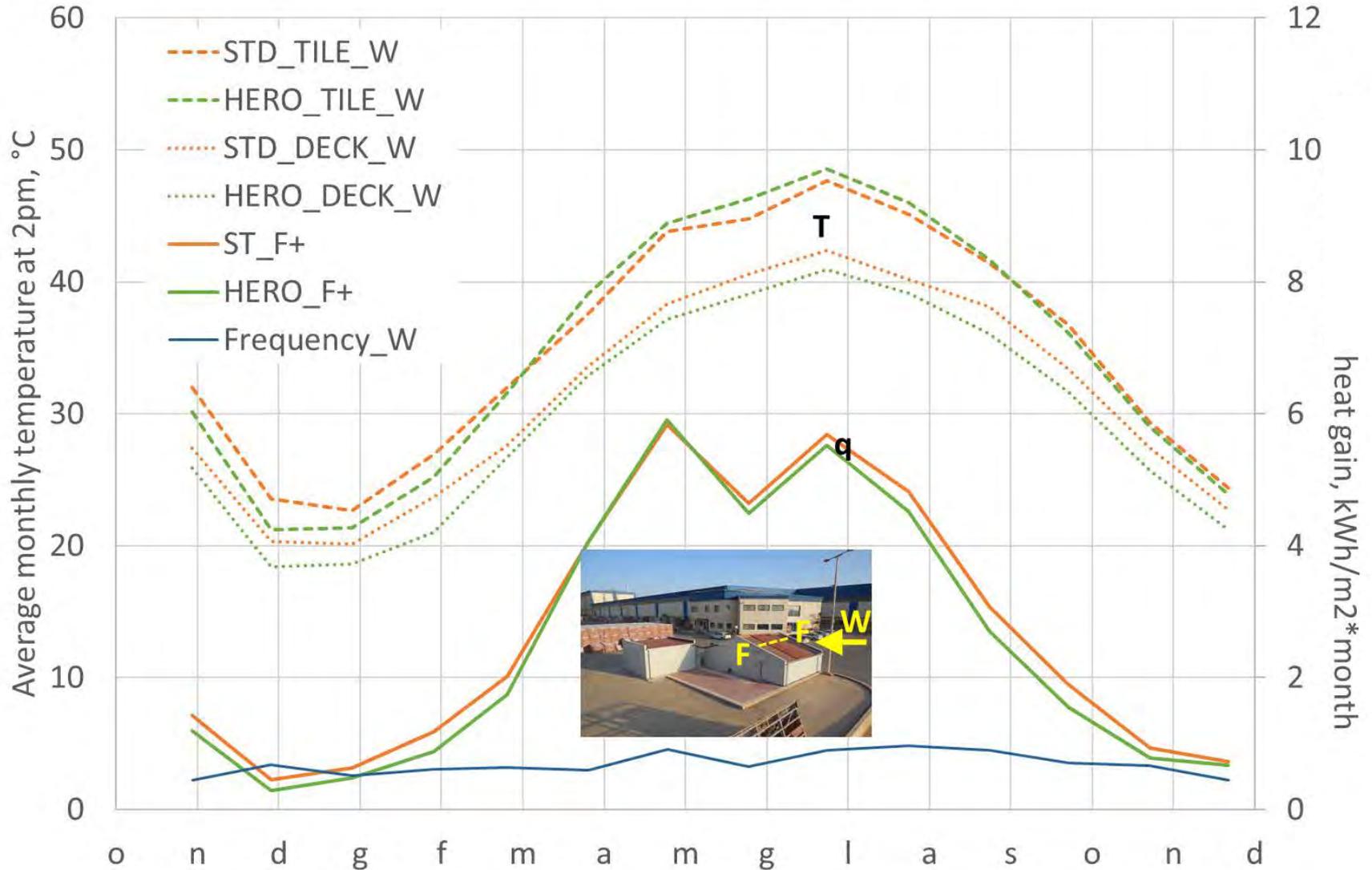
**Reggio Emilia, Italia**



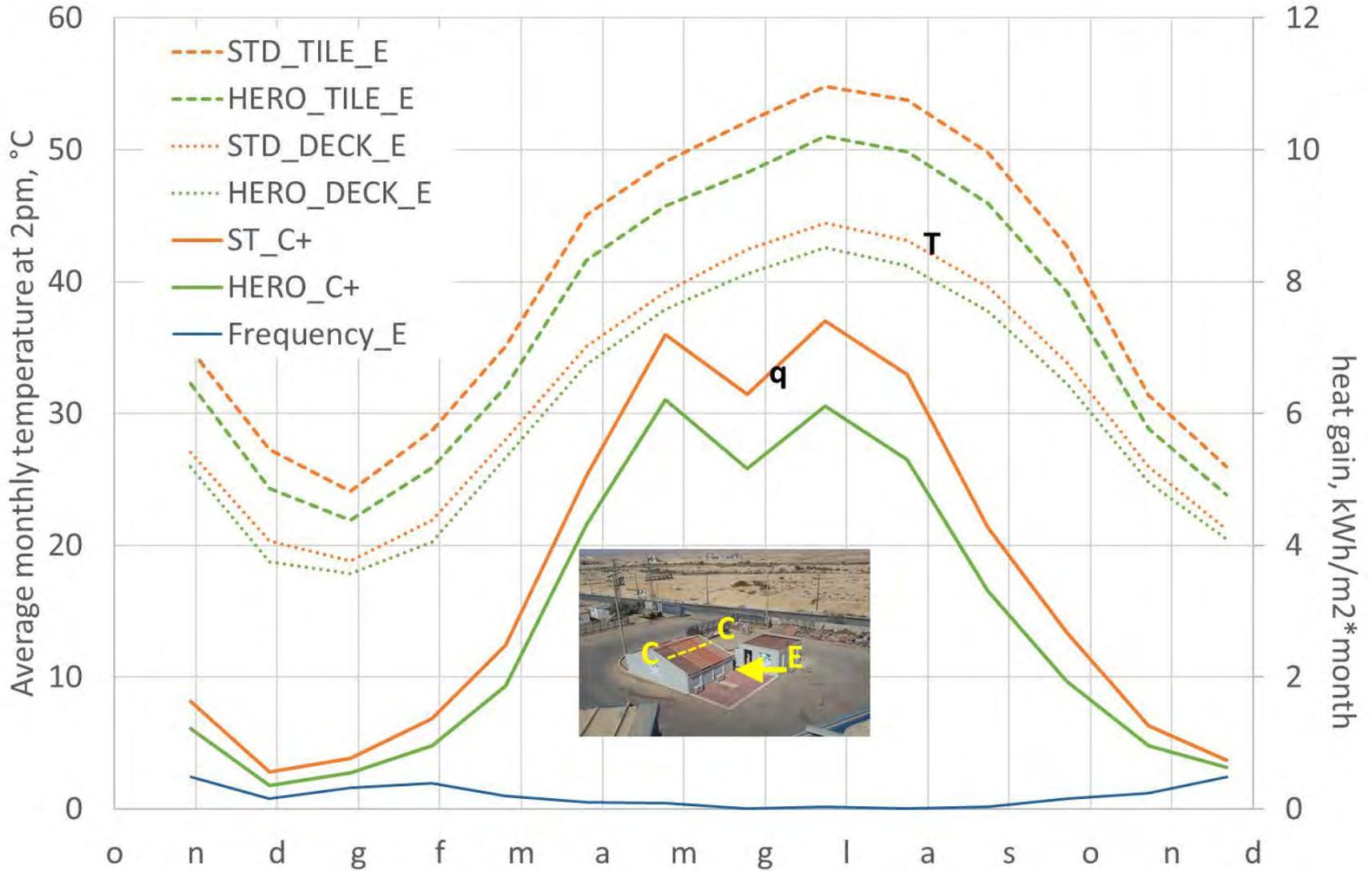
# Primi risultati



# medie mensili falda sopravento

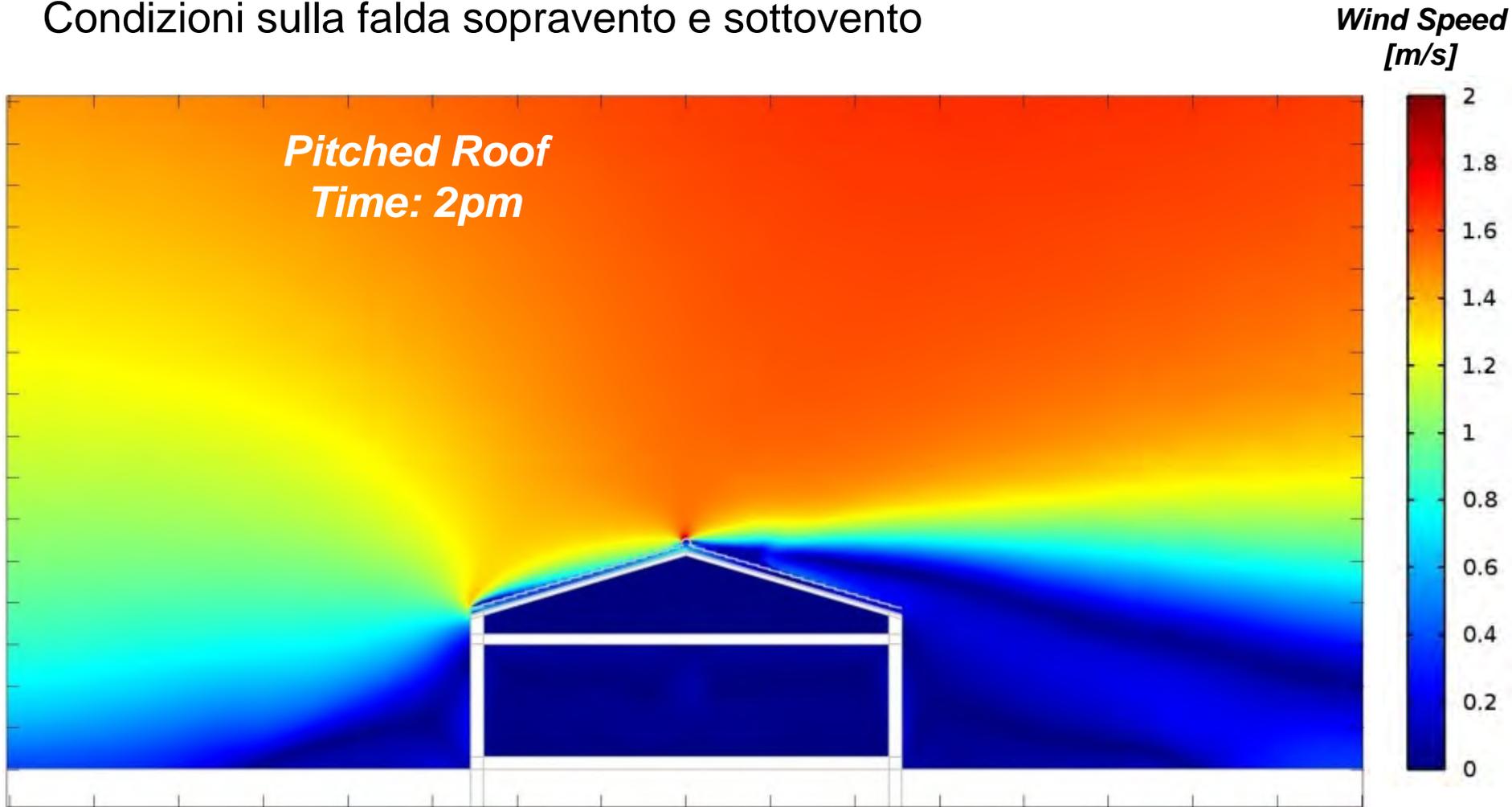


# medie mensili falda sottovento

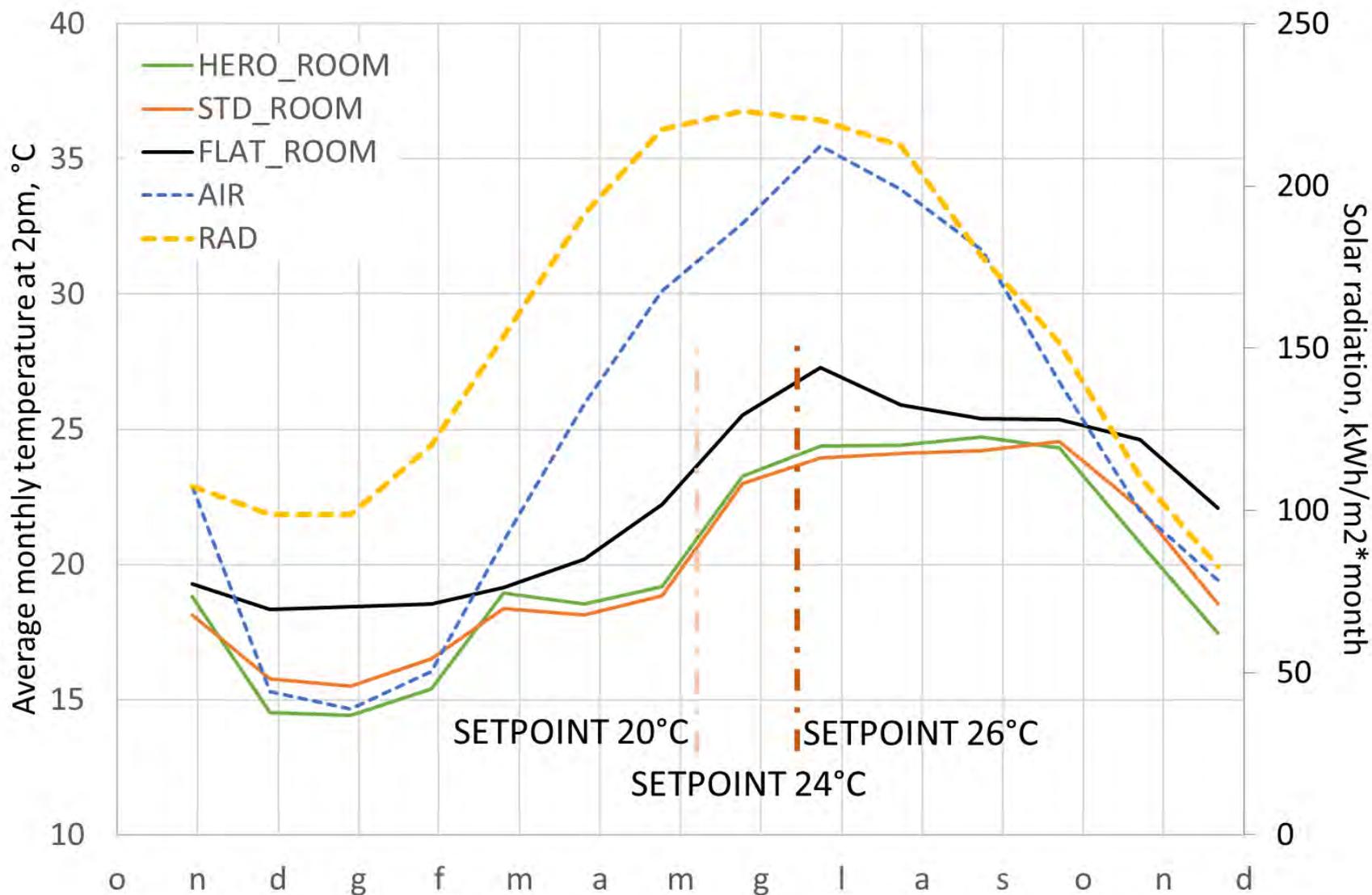


## Simulazioni al computer

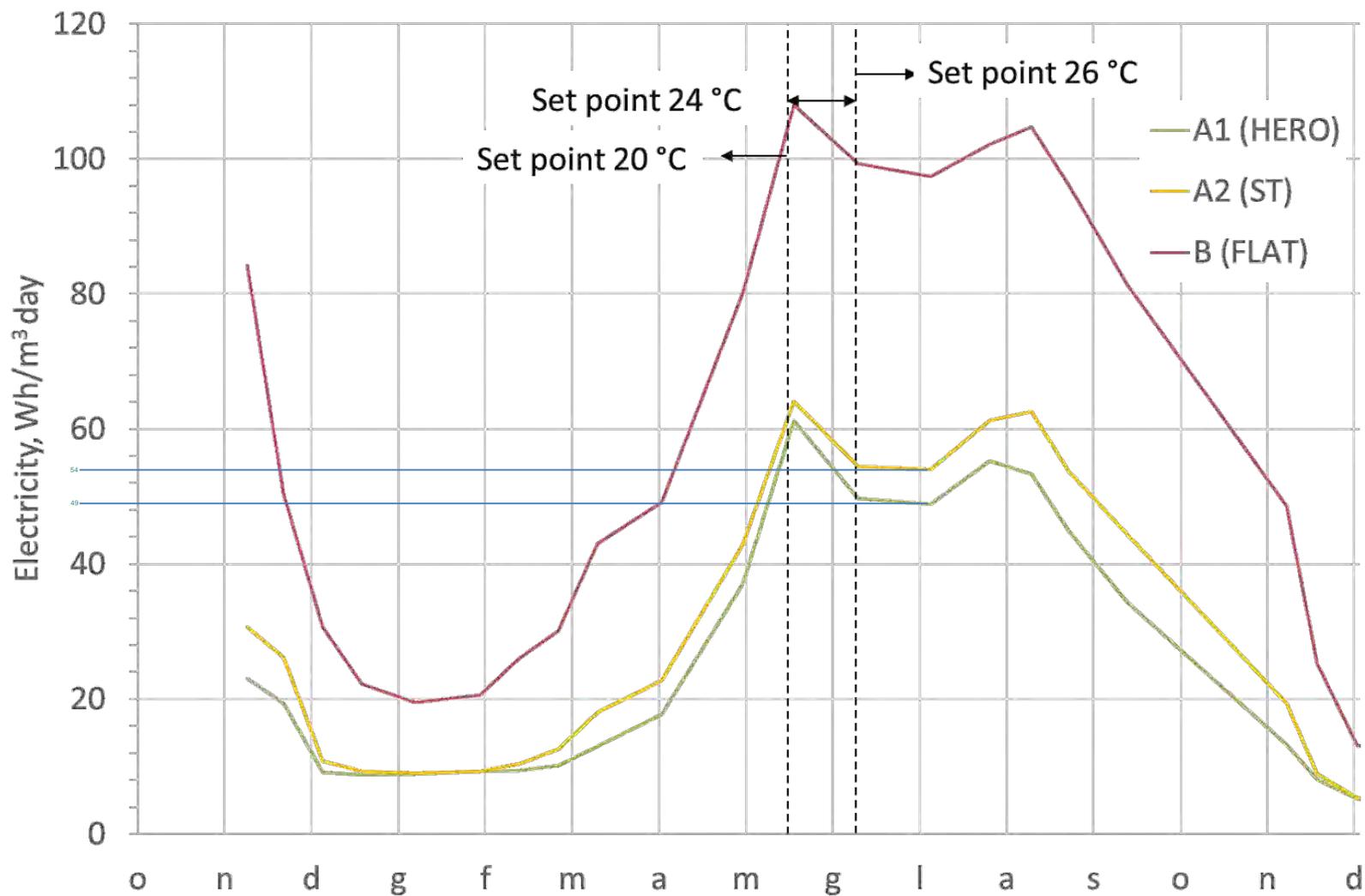
Simulazioni fluidodinamiche al contorno del tetto.  
Condizioni sulla falda sopravvento e sottovento



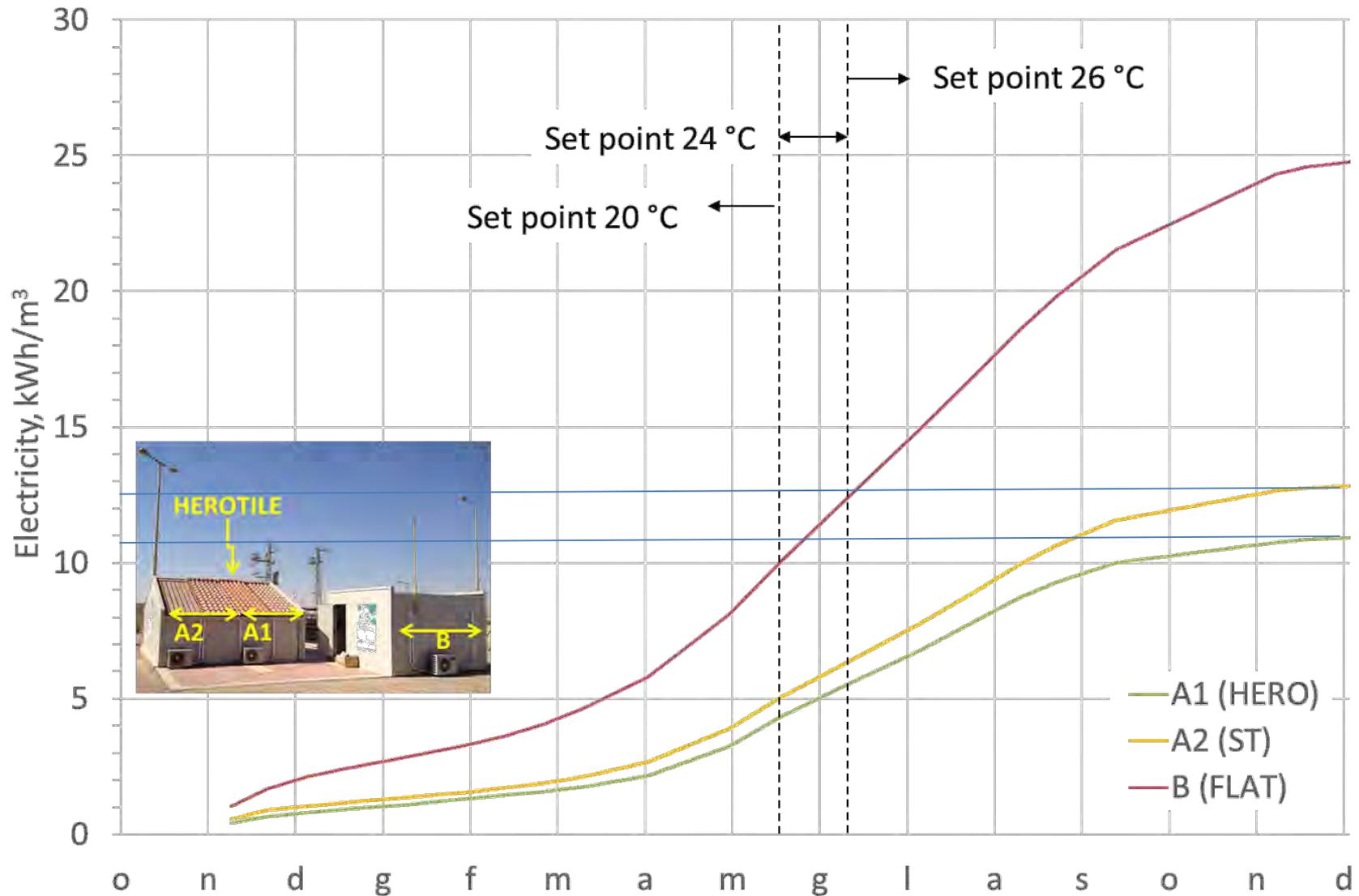
# temperatura media mensile (2 pm)



# elettricità giornaliera per raffrescamento



# energy supply



# SENSAPIRO

## Software energy saving pitched roof

**Different years in epw file**    **Software ENergy SAVings Pitched ROofs**     

### LOCATION PARAMETERS

Year 1995

F:\sensapiro\_10\_10\_2018 NEW  
\\CHN\_Hong.Kong.SAR.450070\_CityUHK.epw

Latitude (deg) 22.32  
(-90..90)  overwrite

Longitude (deg) 114.17  
(-180..180)  overwrite

Timezone 8  
(-11..14)  overwrite

Urban Context **urban: high dens.**  
urban\_medium dens.

### TIME RANGE

From 1 To 15

January	January
February	February
March	March
April	April
May	May
June	June
<b>July</b>	<b>July</b>
August	August
September	September
October	October
November	November
December	December

### ROOF PARAMETERS

Roof average height (m) 5

Roof tilt (deg) 20

Roof Azimut (deg) 45

Roof type **Portoghese Hero**

Eave **open**

Setpoint temp (°C) 25

Min diurnal radiance (W/m2) 25

ASV factor 1

### LAYERS

Number of layers **5**

lock chart scale

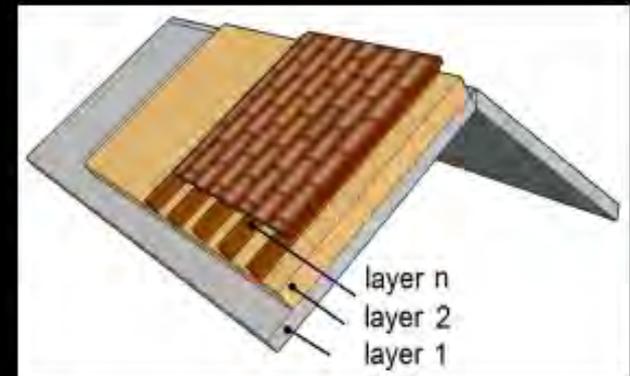
 

# SENSAPIRO

## Software energy saving pitched roof

### LAYERS

Layer 1 to Layer n	Thickness (mm)	Thermal conductivity (W/mK)	Density (kg/m <sup>3</sup> )	Specific heat (J/kgK)
L1 Intonaco calce e gesso	20	0,54	1500	1000
L2 Blocco forato	180	0,35	750	840
L3 Cfs armato	60	1,8	2500	1000
L4 XPS	60	0,036	30	1200
L5 Plastica	5	0,25	1700	1400



Calculate  
Decrement  
Factor

0,10721

*Dec. factor = 0,10721*

*Thermal transmittance timeshift = 10,254 (h)*

*Periodic thermal transmittance = 0,044 (W / m<sup>2</sup> K)*

*Internal thermal admittance = 3,392 (W / m<sup>2</sup> K)*

*External thermal admittance = 1,078 (W / m<sup>2</sup> K)*

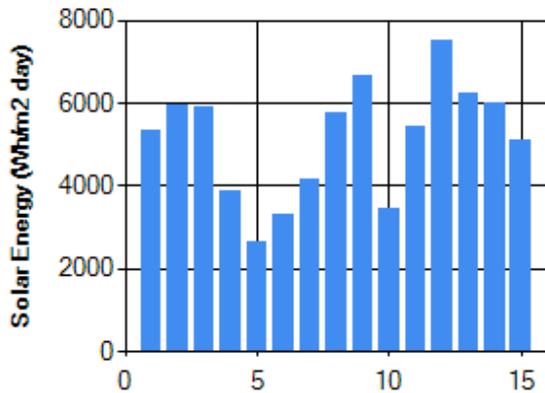
*Component thermal resistance = 2,271 (m<sup>2</sup> K / W)*

*System thermal resistance = 2,441 (m<sup>2</sup> K / W)*

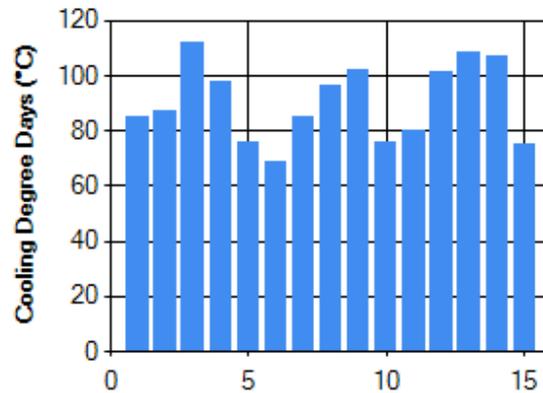
BACK

# SENSAPIRO

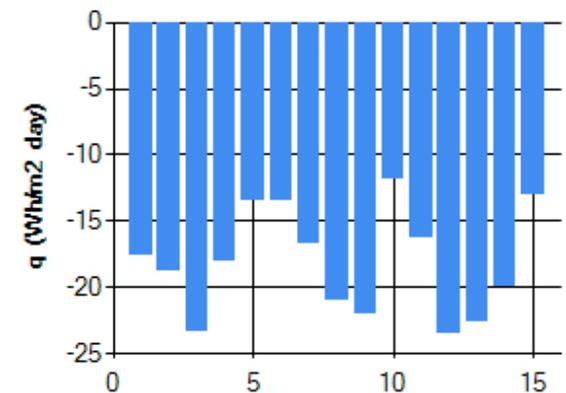
## Software energy saving pitched roof



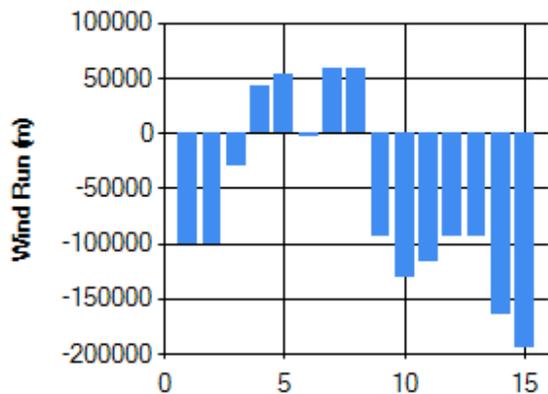
Average = 5154,6



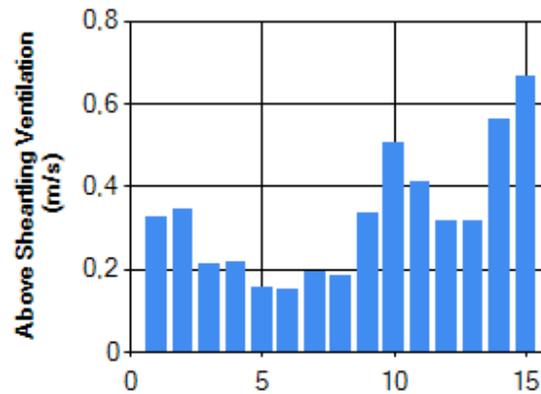
Average = 90,533



Average = -18,116



Average = -60431,8



Average = 0,327

Period: 1/7-15/7 15 days

**Sensible Cooling Load = -272 (Wh/m2)**

Outdoor average temperature = 28,95 °C

Setpoint T: 25

Dec. factor: 0,10721

Roof tilt: 20

Roof average height: 5

Roof Type: Portoghese Hero

Eave: open

Urban context: urban: high dens.

Location: HONG KONG

Number of layers: 5

fASV: 1

Roof azimuth: 45

Generate report

CLOSE

# Grazie

Giovanni Zannoni  
zannoni@unife.it

lifeHEROTILE

LIFE14 CCA/IT/000939 - LIFE HEROTILE  
LIFE Climate Change Adaptation  
project application

www.lifeherotile.eu

TILE

lifeHERO

High Energy savings in building cooling  
by ROof TILES shape optimization  
toward a better above sheathing ventilation