



# Stati Generali del Solare Termico

## A CONCENTRAZIONE

### UNIVERSITY OF FLORENCE

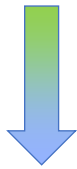


The University of Florence (originates from the Studium), founded in 1321.

In 1472 it migrates in Pisa (maybe the escape of “brains” ).

In 1859, falls as the “Institute of Higher Learning” and it was finally recognized in 1923

**Heavily urbanized** areas play a key role in achieving climate neutrality by 2050, the goal of the European Green Deal. These areas represent **only 4%** of the EU land area, but **75%** of EU citizens live in them. Furthermore, these areas absorb over **65%** of the energy and account for over **70%** of global CO<sub>2</sub> emissions.



It is clear that we cannot fail to start from these areas if we really want to achieve the objectives of the Green-Deal.



## European Climate Law

[https://ec.europa.eu/clima/eu-action/european-green-deal/european-climate-law\\_en](https://ec.europa.eu/clima/eu-action/european-green-deal/european-climate-law_en)

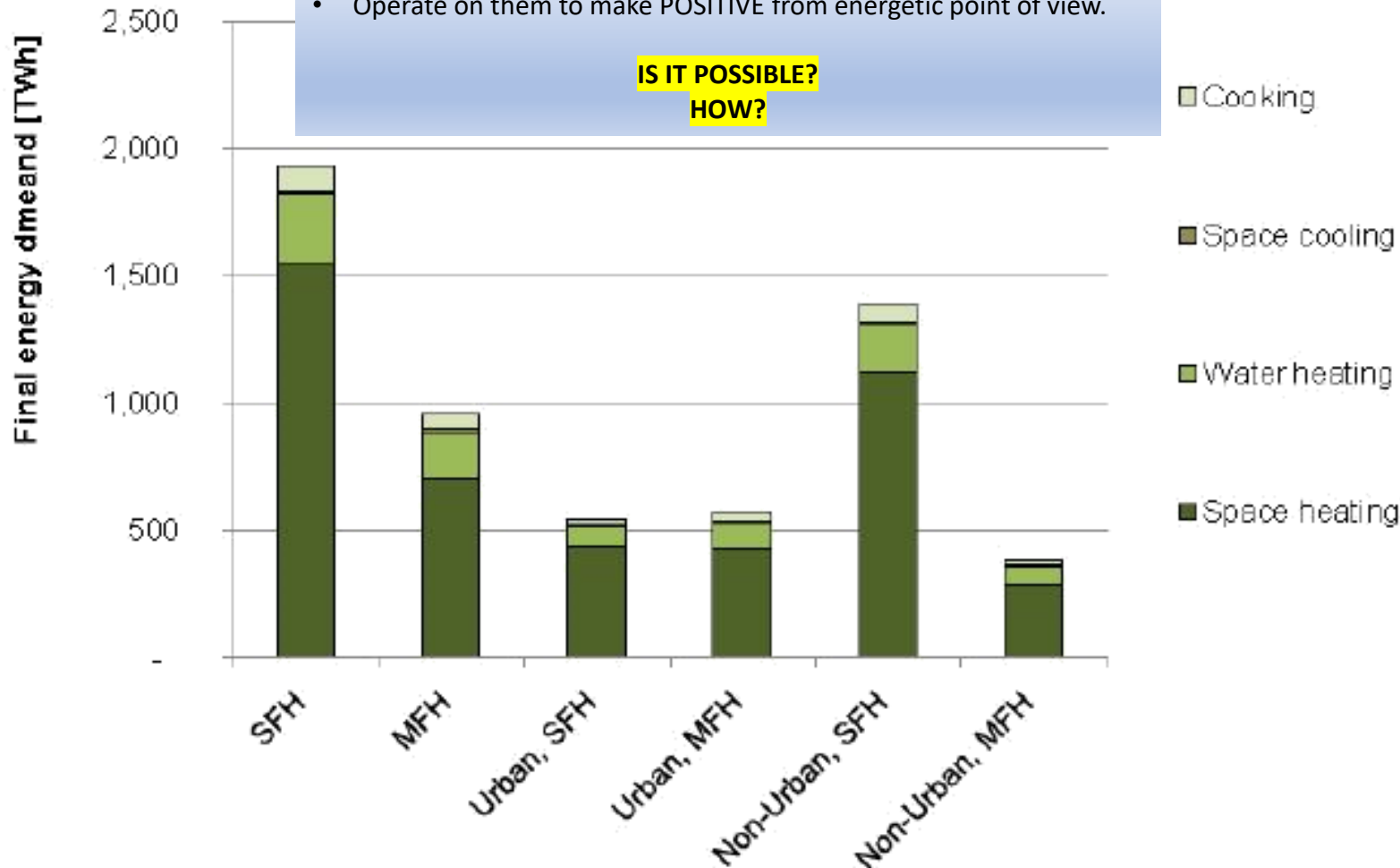
Experience shows that the highly anthropized environments, such as urban contexts, are characterized by the presence of limited spaces that can be made available for renewable sources. In these contexts, the key to the diffusion of renewable energy systems is the creation of systems that can be easily integrated in the context and mainly in the buildings. In this context, if flat solar systems are an efficient response to the production of low temperature thermal energy, NEW solutions need to be developed for medium and high Temperature up to 150-300 ° C

## PROPOSED procedures EU approach - PED

The **PED Approach** is:

- Divide the EU territory in DISTRICTS
- Operate on them to make POSITIVE from energetic point of view.

**IS IT POSSIBLE?  
HOW?**



**Heating&Cooling** constitutes 50% of the final energy demand in Europe and represents by far the largest energy sector to be decarbonized.

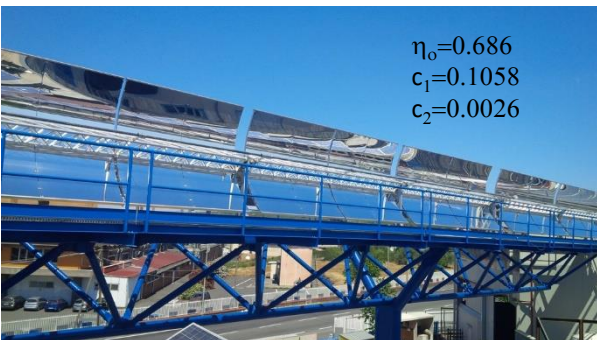
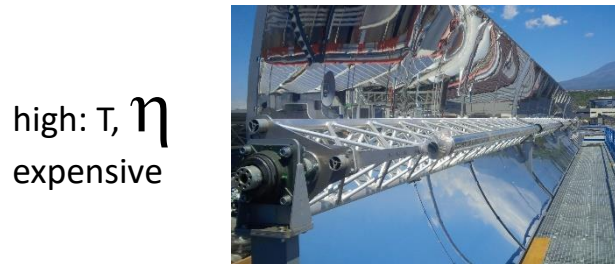
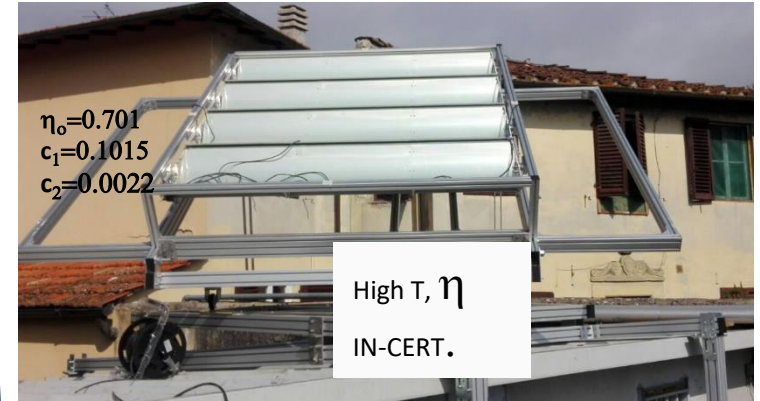
*it is essential to highlight that electricity represents today only about 23% of the final energy consumption in EU-27. Therefore, despite the strong electrification trend, REPowerEU has to have a more balanced focus on heating&cooling*

In the Europe all buildings are responsible for around 40% of total consumption, and the residential sector for 26%. Since 2000 consumption of the sector has grown significantly and the vast majority (78%) **is used for space heating and domestic hot water**. In 2019, most energy for heating and cooling was produced from fossil fuels (75% of the total), while renewable sources only provided 22%.

# SOLAR TECHNOLOGIES for URBAN AREA

Research group : Prof. Ing MAURIZIO DE LUCIA

$$\eta = \eta_0 - c_1 \Delta T_m - c_2 \Delta T_m^2$$



Low cost,  $\eta$

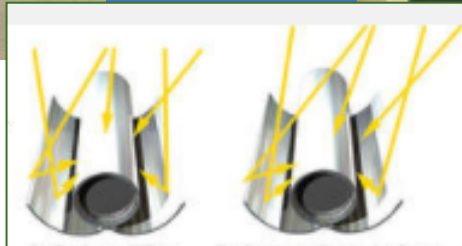
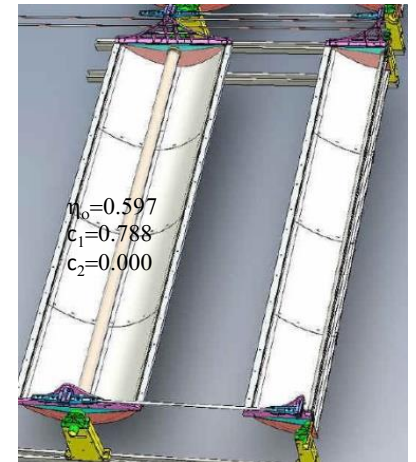
High  $T, \eta$   
NO CERT.

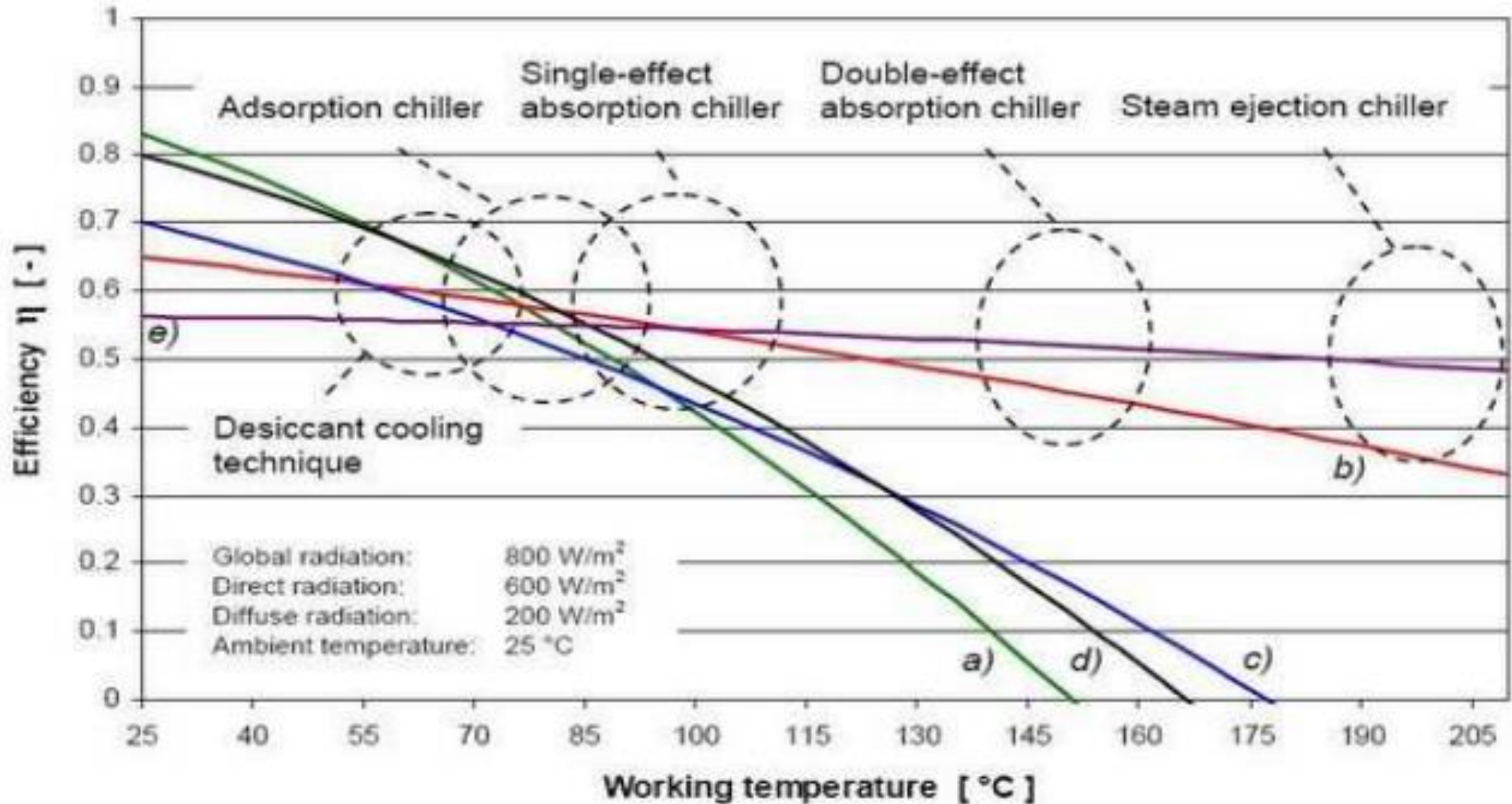
high:  $T, \eta$   
BAT for building



BAT:  $T, \eta$

Certified, low- $\eta$





**Fig. 6:** Comparison of different collectors at  $800 \text{ W/m}^2$ . a) Single glazed flat-plate with AR, b) Evacuated tube collector of the Sydney type, c) CPC flat-plate with Teflon foil, d) Flat-plate with double AR-glazing and inert gas filling, e) Small parabolic trough (under development; only the fraction of direct radiation =  $600 \text{ W/m}^2$  can be used). The values are for normal irradiance and refer to the aperture area.

JORDAN - Plant



CATANIA - Plant

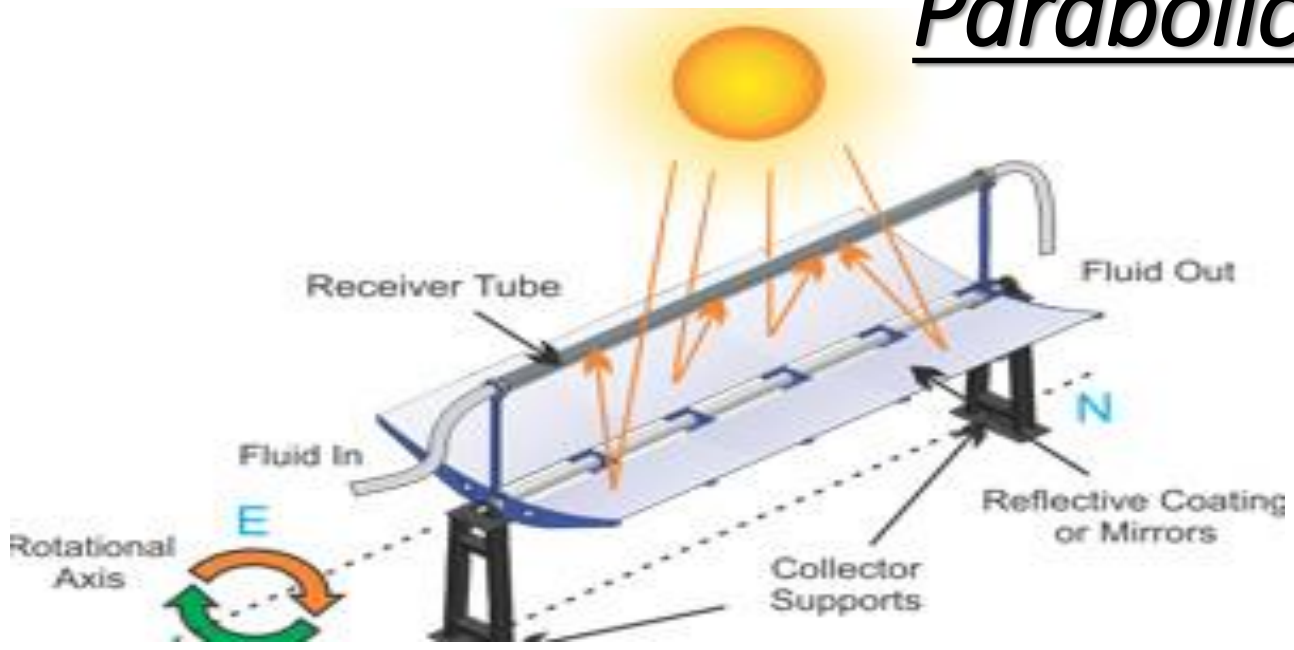
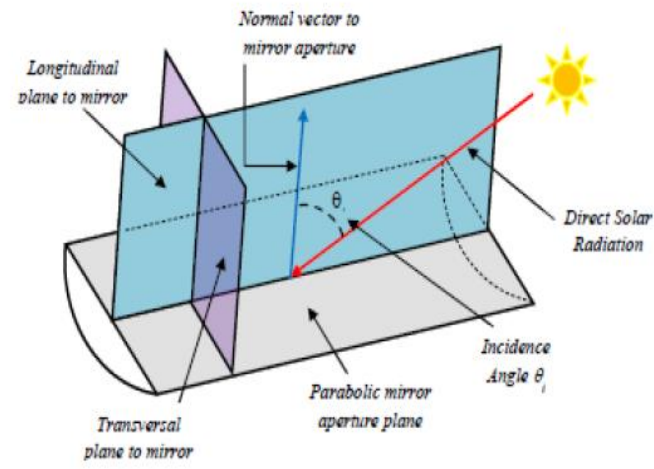


# Parabolic Trough Collectors

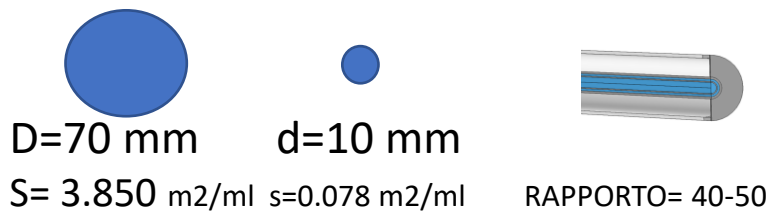


# Parabolic Trough Collectors

- A parabolic trough is a type of solar thermal collector that is straight in one dimension and curved as a parabola in the other two, lined with a polished metal mirror. A black metal tube, covered with a glass tube, is placed along the focal line of the receiver.

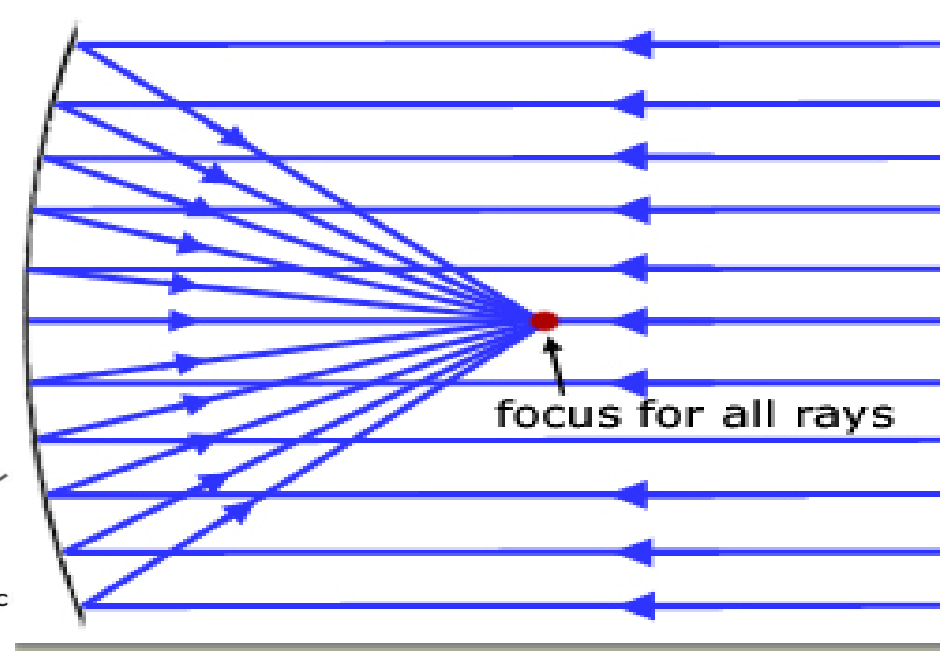
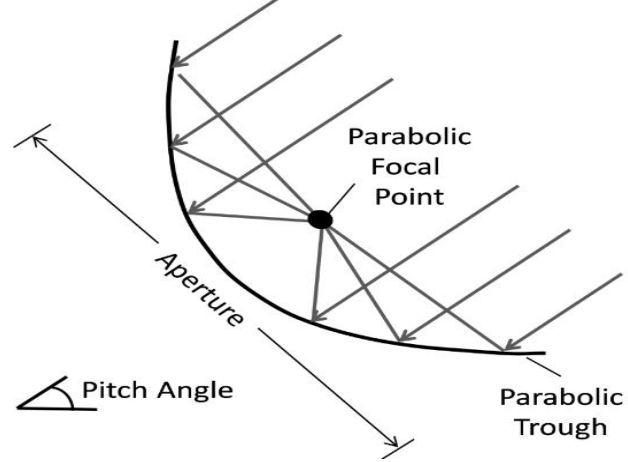


## PECULIARITA'



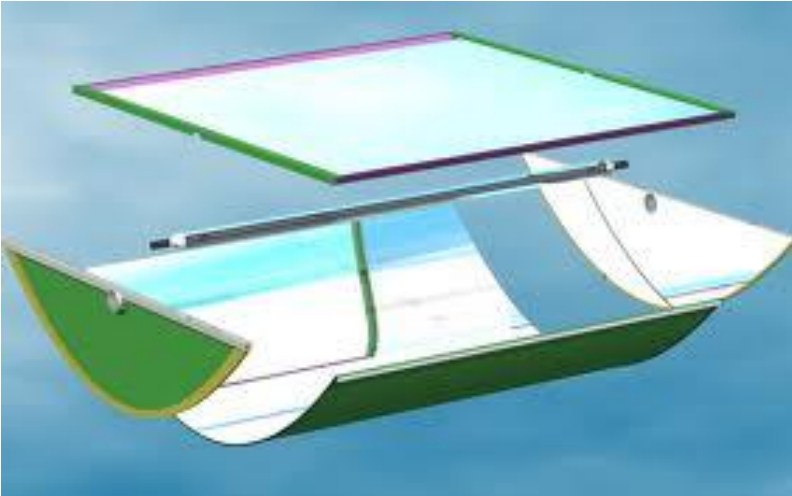
Apertura di 6000mm Potrebbero diventare 125 mm  
 Lunghezza: dipende dalla FOCALE per via dell'END.LOSS

**PARABOLE:** it is a geometric shape where all the rays parallel to the optical axis are reflected on the focus.



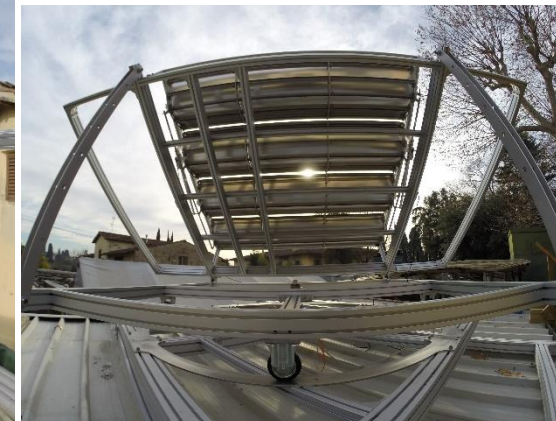
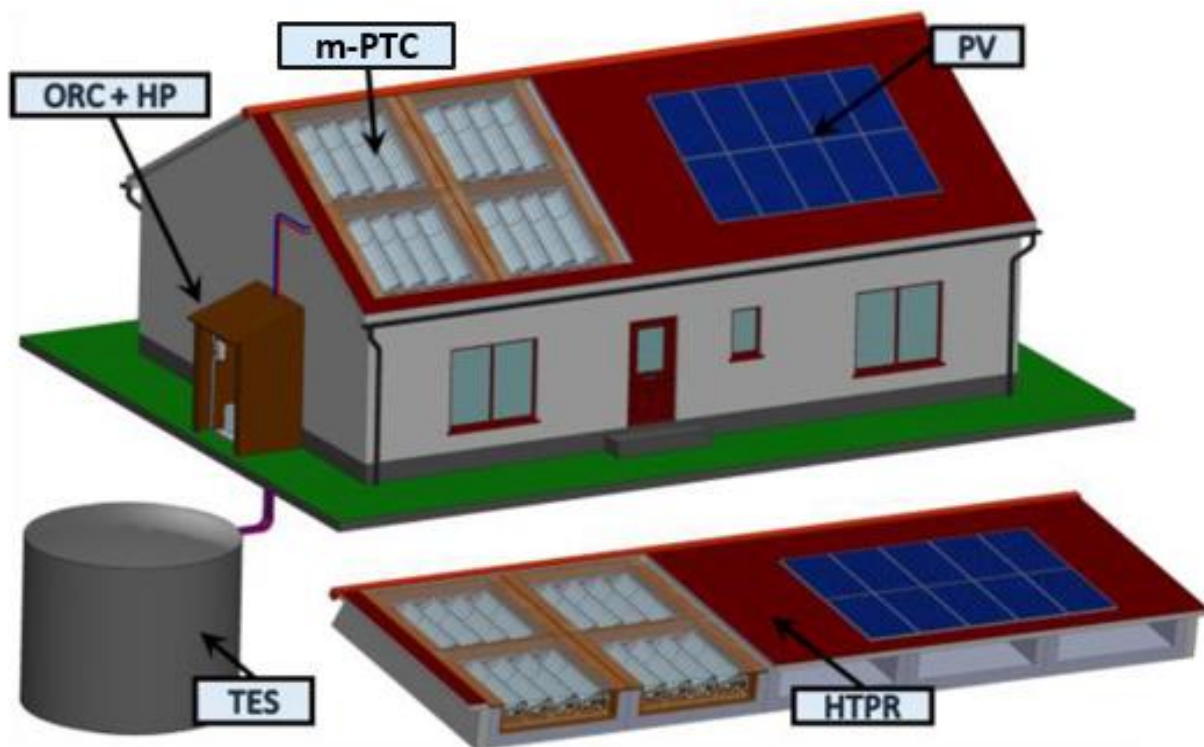


- Application of PTC technology in residential environments or SHIP  
Industrial process



# Energy & Mini-Grid

- Hybrid plants with m-PTC, PV, ORC, Heat Pump e storage TES.



DNI	1400	kWh/m <sup>2</sup> y
Specific Demand	40	kWh/m <sup>2</sup> y
Area (residential)	200	m <sup>2</sup>
Annual Demand	8000	kWh/y
m-PTC	12	m <sup>2</sup>
PV	4	m <sup>2</sup>
Net Useful Energy	5174.5	kWh/y
<b>m-PTC SOLAR FRACTION</b>	<b>65%</b>	
<b>m-PTC+PV Solar Fraction</b>	<b>100%</b>	

Annual costs for producing 8000 kWh/y with different technologies						Current	SyRENs
Standard Plant	Spec_cost	fuel cost	Other&DUE	TOT costs	PBT	PBT	
Gas Boiler	0.098 €/kWh	€ 784	€ 196	980 €/y	17.49	9.55	
Pellet Boiler	0.071 €/kWh	€ 565	€ 282	847 €/y	20.41	11.22	
Heat Pump	0.071 €/kWh	€ 391	€ 293	684 €/y	20.31	10.21	
Diesel Boiler	0.171 €/kWh	€ 1.365	€ 171	1535 €/y	10.92	5.85	

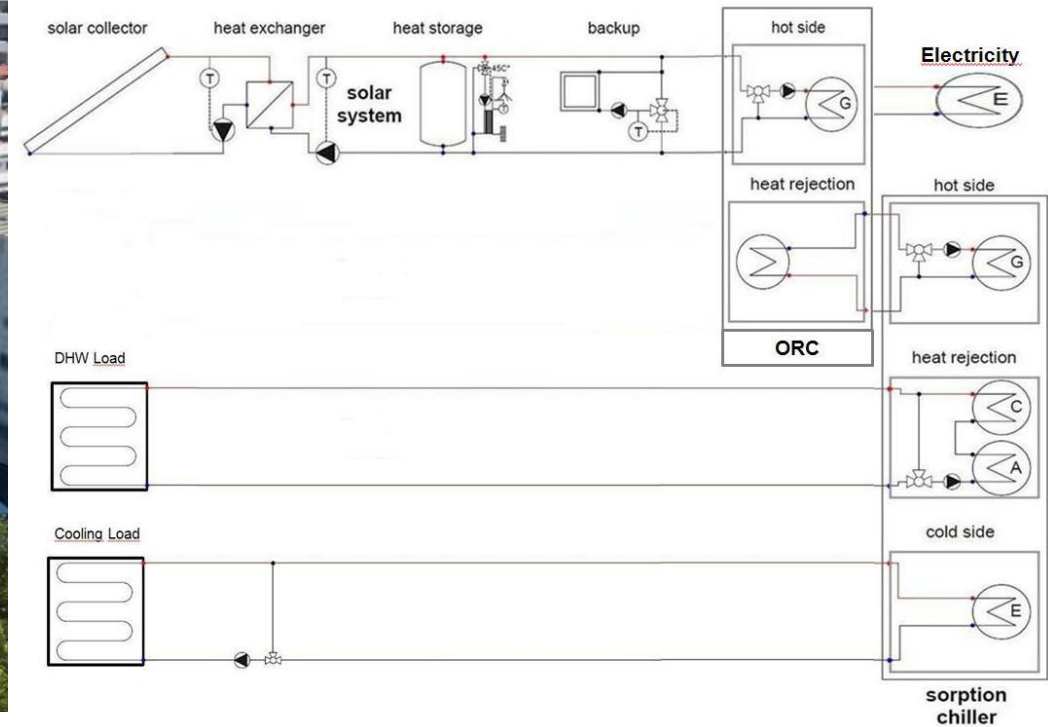
Current COST		
PLANT	€	2.240
SOLAR FIELD	€	7.200
TES	€	4.000
HP	€	3.500
PV	€	714
<b>TOTAL</b>	<b>€</b>	<b>17.654</b>
<b>Specific Costs</b>	<b>3 €/kWh</b>	
<b>Specific Costs</b>	<b>88 €/m<sup>2</sup></b>	



# M-PTC last VERSION

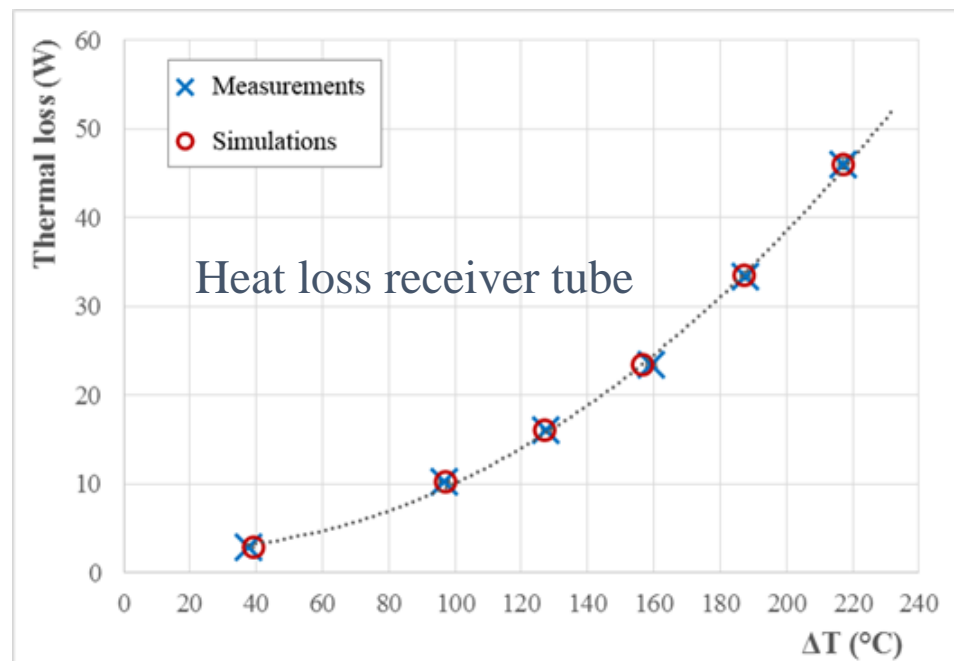
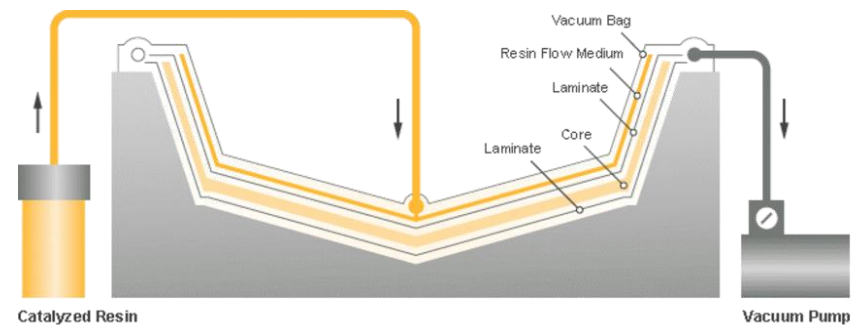
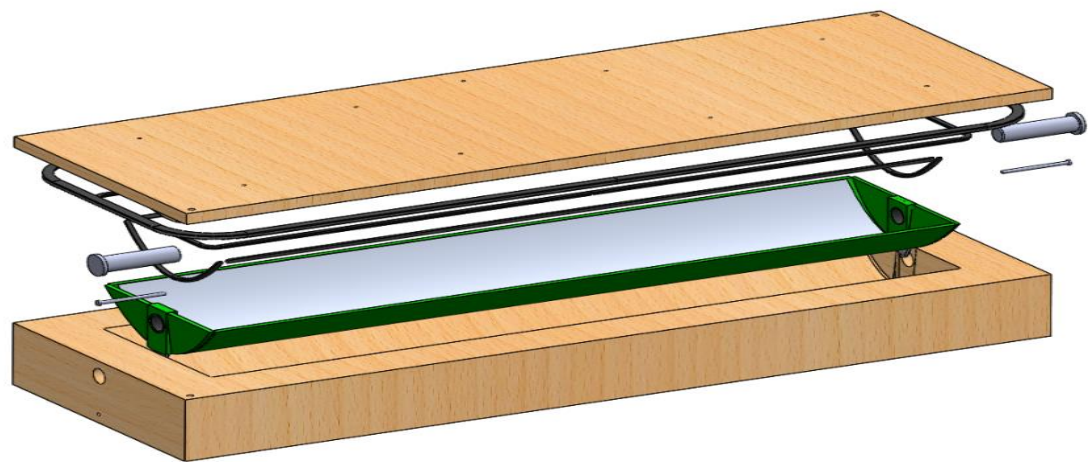
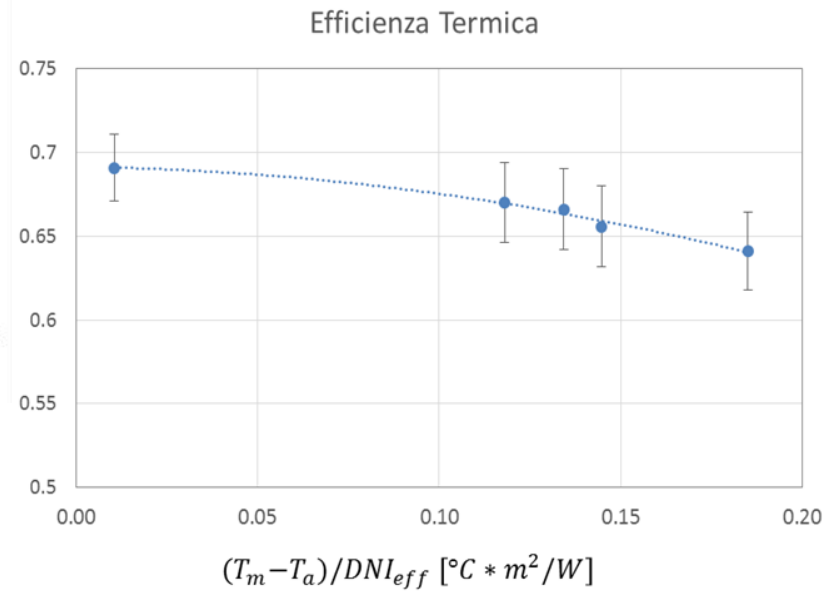
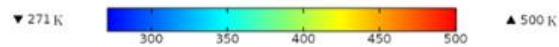
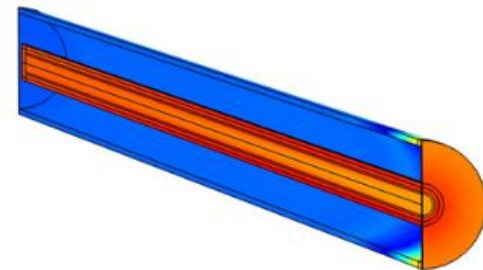
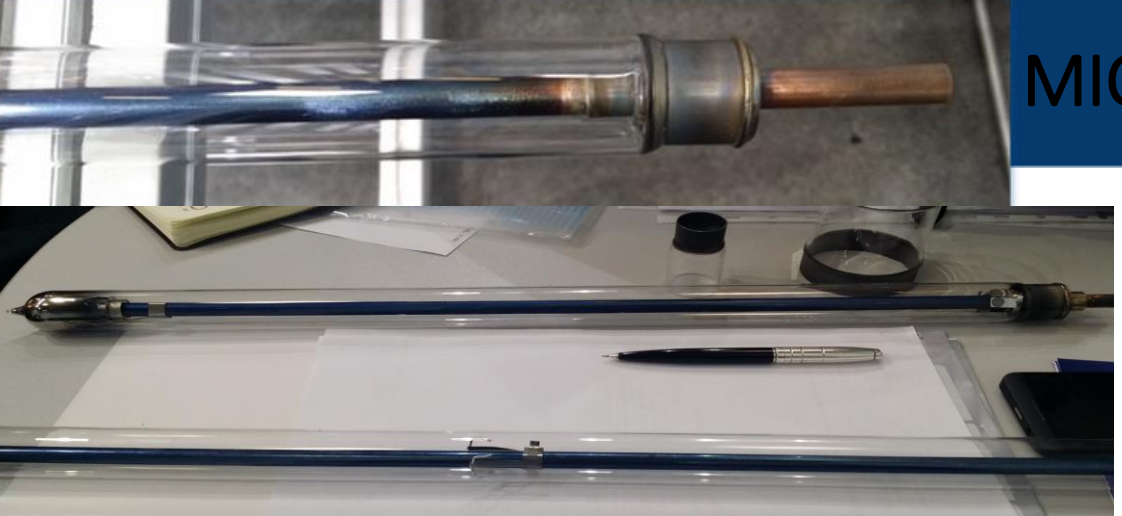


# PED – SOLUTION with m-PTC



# Micro-PTC





# OBJECTIVE

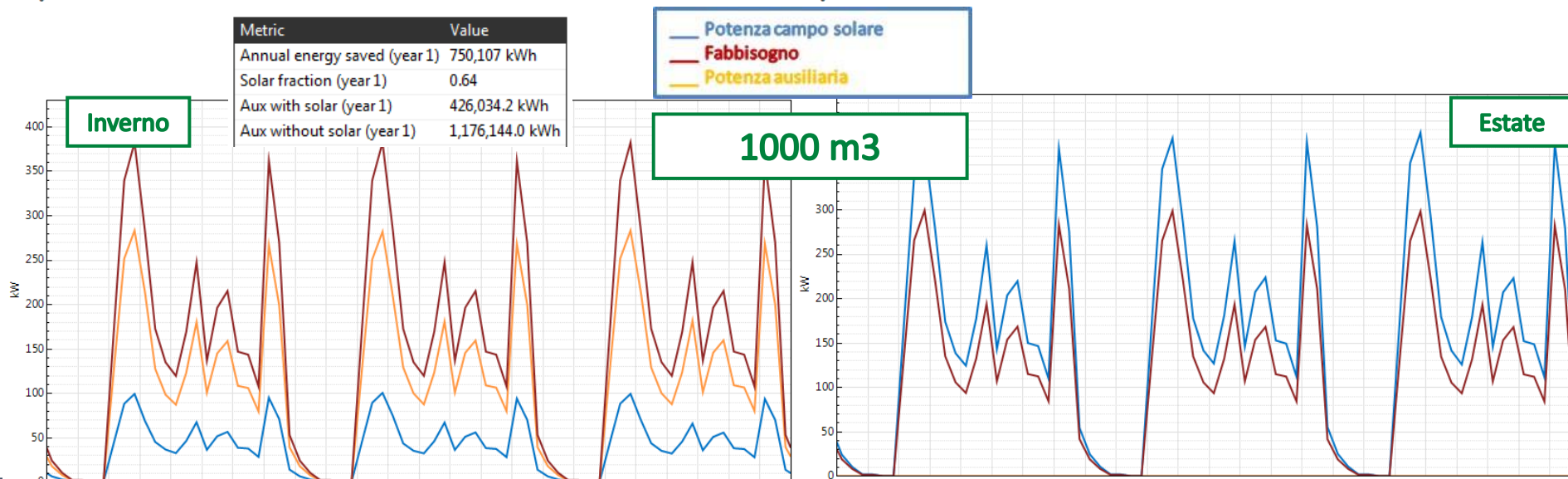
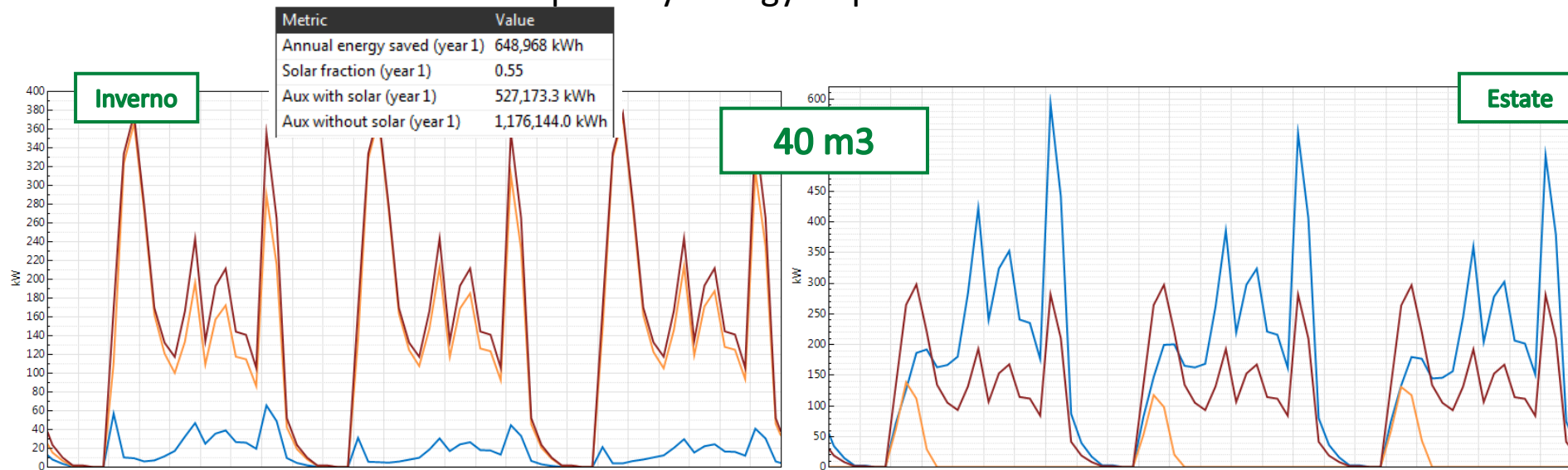
## Renovation of the district in Via della Casella (FI) with construction of SDH

- **10 building blocks (25 buildings)**
- **Solar Usable area 3930  $m^2$**

1. Best system configuration
  - **Centralized storage**
  - **Distributed storage**



# HYBRIDIZATION OF BIOMASS OR EXISTING DISTRICT HEATING NETWORKS THANKS TO THE SOLAR SOURCE to reduce the primary energy requirement. DIFFERENCE between 40 m3 TES and 1000 m3 TES





A photograph of a solar field laboratory. In the foreground, there are several rows of solar collectors mounted on metal frames. The collectors are blue and arranged in a grid. In the background, there is a two-story house with a red-tiled roof and light-colored walls. The house has several windows and a balcony. The sky is blue, and there are trees and a utility pole in the background.

THANK YOU

Thanks for resisting

UNIFI-SOLAR FIELD LABORATORY