



# IEA SHC Task 40/ECBCS Annex 52

## Towards Net Zero Energy Solar Buildings

<http://www.iea-shc.org/task40/>

*Workshop*

*October 3, 2012, Palau Robert, Barcelona, Spain*

# The Leaf House case - study



# The Leaf House case - study



Consumptions:

**15/20 kWh/m<sup>2</sup> year**  
for the apartments.

If the thermal plant is  
considered  
**55 kWh/m<sup>2</sup> year**



**The Leaf House**  
**Angeli di Rosora**  
**ITALY**

- Six apartments
- 480 m<sup>2</sup> heated surface
- North – South orientation
- Wide glazings on the southern facade



# The Leaf House case - study

## Building envelope

Insulated walls ( $U=0.15 \text{ W/m}^2\text{K}$ )

- 18 cm external layer of EPS ( $\lambda=0.036 \text{ W/mK}$ )
- 30 cm Poroton block ( $\lambda=0.3 \text{ W/mK}$ )

Double-pane insulated glazing filled with argon ( $U=1.4 \text{ W/m}^2\text{K}$ )

- 6 mm external glass
- 14 mm gap filled with argon
- 4 mm external glass

### OUTER SURFACE

20.00 mm Intonaco Plastico per Cappotto

180.00 mm Pufix EPS-100

300.00 mm Blocco Poroton 30 cm

20.00 mm Malfa di Gesso per Intonaci

### INNER SURFACE



## Ventilation

- No natural ventilation strategies except for some night cooling during summer ( according to the needs of the occupants)
- Mechanical ventilation stopped by sensors when the windows are open and started when CO2 setup levels are reached

## Shadings

The Solar thermal system and the balconies acts as shadings for the south façade windows

# The Leaf House : solar systems



The LH has a grid-connected PV system (20 kW nominal power) composed of 115 panels. The system covers the entire roof surface (150m<sup>2</sup>), facing the south. The panels are arranged in nine strings and are connected to three inverters. The nominal declared efficiency of the PV panels is 12%.

Seven solar thermal collectors heat the water connected to the main heat storage thermal tank, covering all the needs of domestic hot water during the summer. During winter the geothermal heat pump integrates the solar system production.

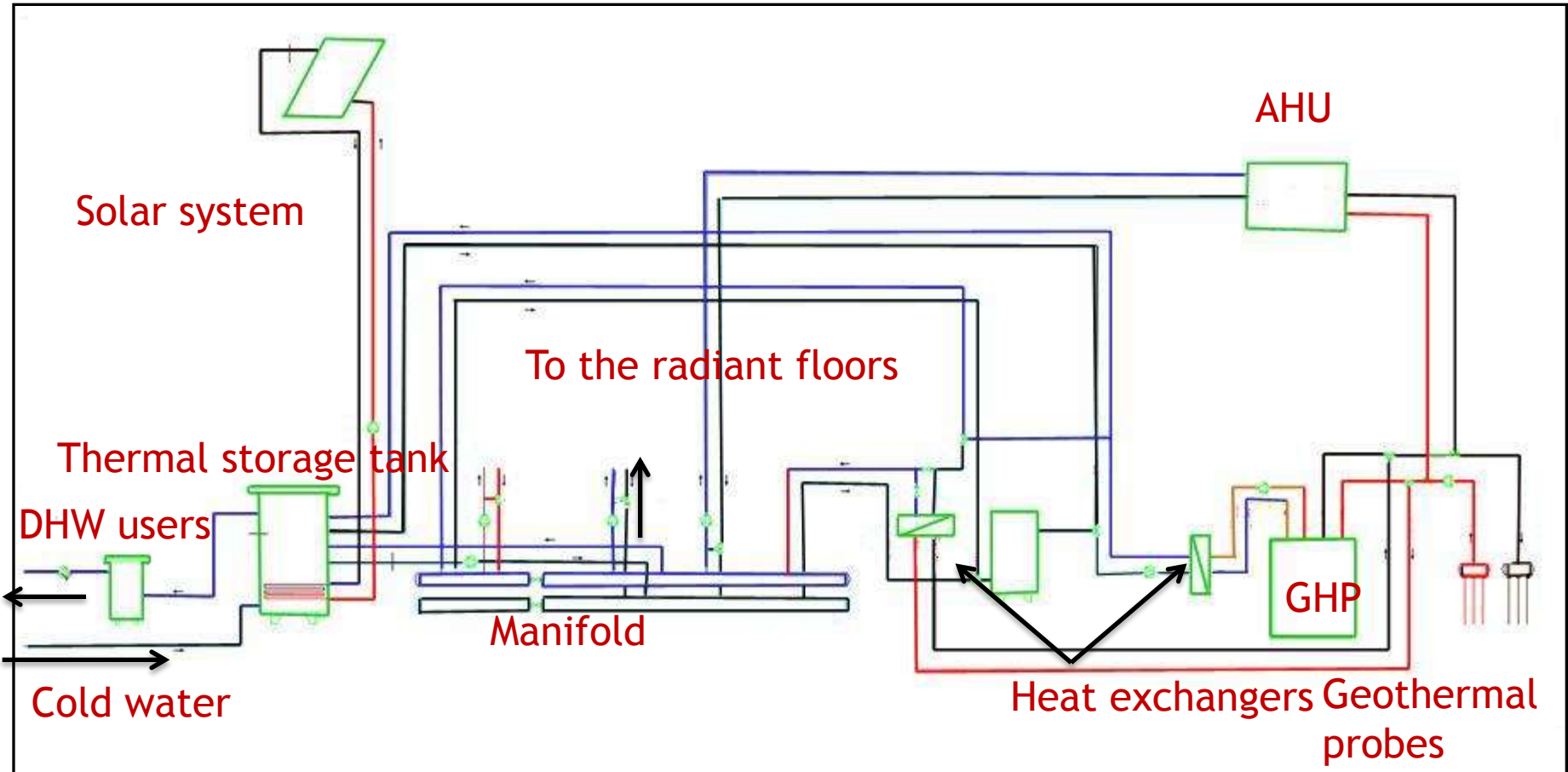
# The Leaf House : radiant floors

- An acoustic insulation layer has been integrated in the system
- The floor is insulated in order to avoid high thermal fluxes towards the lower floors





# The Leaf House : thermal system





## The Leaf House

- More than 1000 sensors with 10 minutes and 1 h detail monitoring weather, the building and the thermal system
- Data is easily collectable from the occupants

## Other Leaf House systems:

- High energy efficient light sources
- High performances appliances
- Building automated solutions
- Water collection and treatment system





# The Leaf House

## Lessons learned

- Very complex plant, need of a very detailed control
- Use of thermal inertial tanks to avoid heat pump too fast ignition cycle



# The Leaf House

## Lessons learned

- Simple is better ( Very high pumps and HVAC system electrical consumption)
- The house is too dependent on the grid, electric storage systems have been implemented some months ago (Lithium batteries)



# The Leaf House case - study

## **Prof. Eng. Maurizio Cellura**

Dipartimento dell'Energia  
Viale dell Scienze, 90128 Palermo  
Email: [maurizio.cellura@unipa.it](mailto:maurizio.cellura@unipa.it)  
[mcellura@dream.unipa.it](mailto:mcellura@dream.unipa.it)

## **Eng. Francesco Guarino**

Dipartimento dell'Energia  
Viale dell Scienze, 90128 Palermo  
Email: [francesco.guarino@unipa.it](mailto:francesco.guarino@unipa.it)  
[guarino@dream.unipa.it](mailto:guarino@dream.unipa.it)