Integration of heat pumps with solar collectors to meet the heating demands of a residential building

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OUR SYSTEM

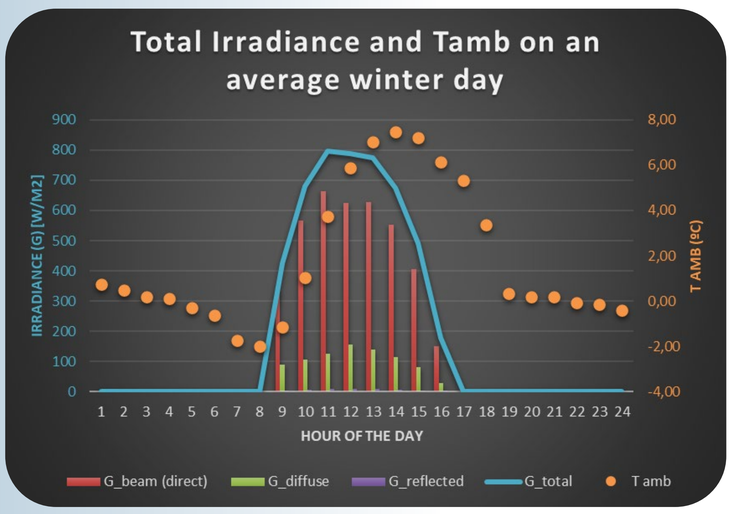
The solar collector heats up the water in the tank . If the temperature of this water is superior to 35°C, it heats directly the water used in the heating floor. If it is lower, the heat pump is used to heat up the water into the heating floor.

HEATING SYSTEM

Solar collector [2]		Heat pump (Water to Water) [3]	
Model	VITOSOL 200-FM	**Model**	WI 18TU (Water to Water)
Supplier	Viessmann	**Supplier**	Dimplex
Commercial area (m2)	2.51	**Max flow T (ºC)**	62
Absorber area (m2)	2.32	**Heat output W10/W35 (kW)**	17.1
Collector type	Flat-plate collector	**COP W10/W35**	5.8
Transfer Coefficient (W/(m²K))		1.2 [4]	
Period of time studied		Average of a winter day (jan-mar)	

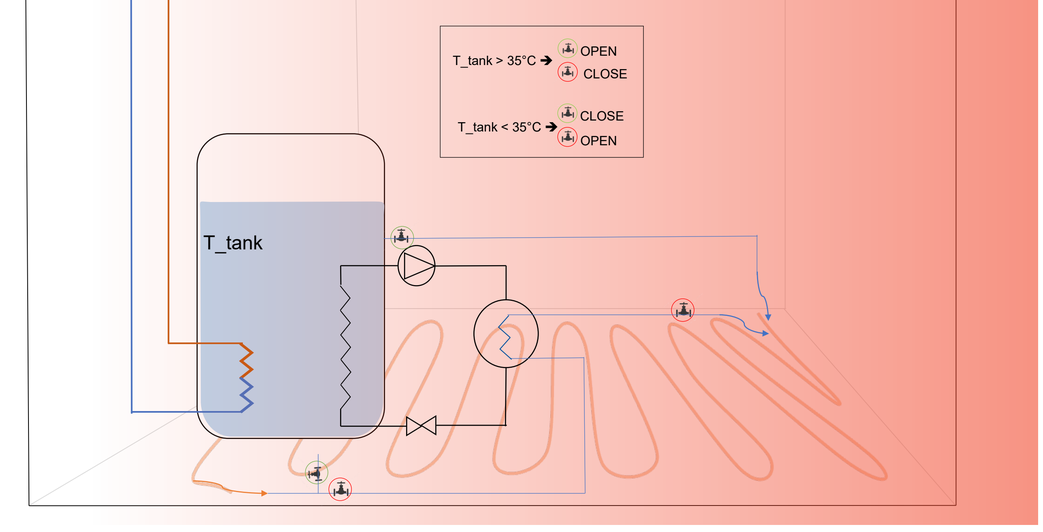
HEAT SOURCE

Location	Munich
Latitude (decimal deg)	48.138
Longitude (decimal deg)	11.578
Elevation (m)	523
Radiation database	PVGIS-SARAH2 [1]
Year of the data	2020
Slop (optimum deg)	42
Azimuth (optimum deg)	- 6



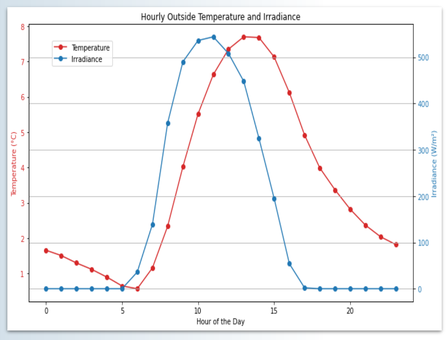
HEAT DISTRIBUTION

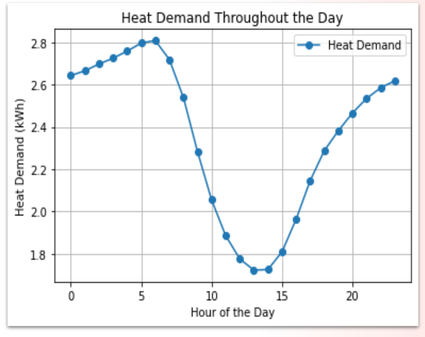
Inhabitants	4
House volume (m³)	234
Floor surface (m²)	90
System Description	Floor heating
T of the heating water (ºC)	35
Initial air T (t = 0) (ºC)	19



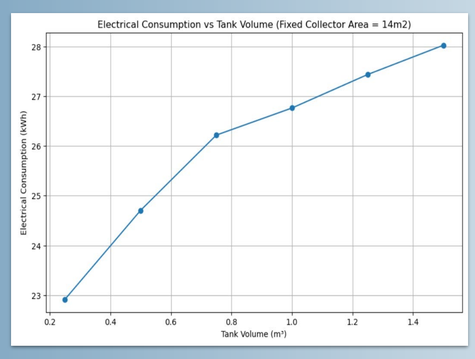
RESULTS

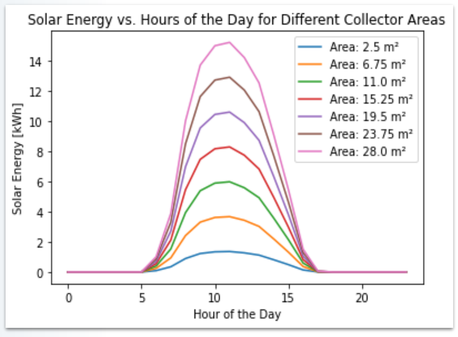
ANALYSIS OF ENVIRONMENT



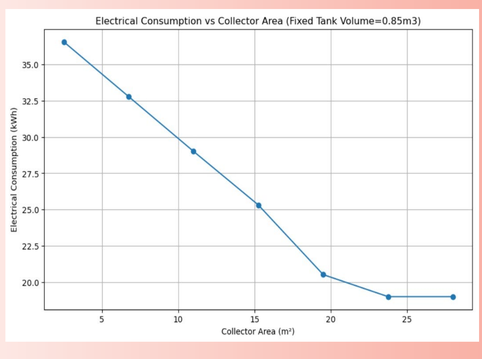


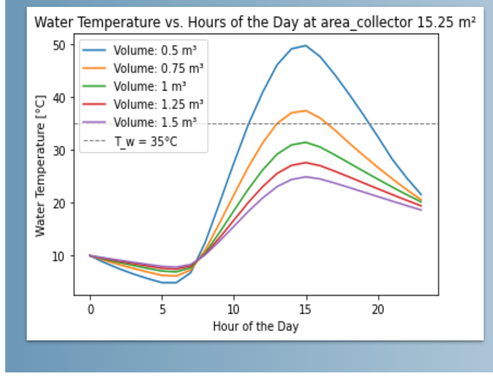
FIXED AREA OF COLLECTOR VARIABLE VOLUME

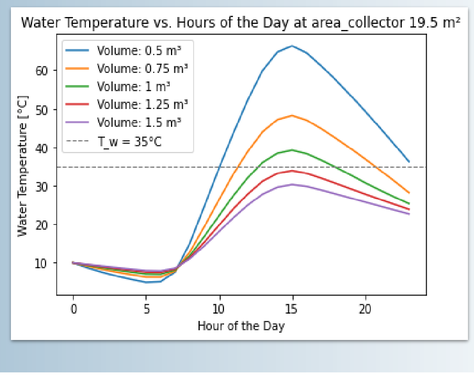


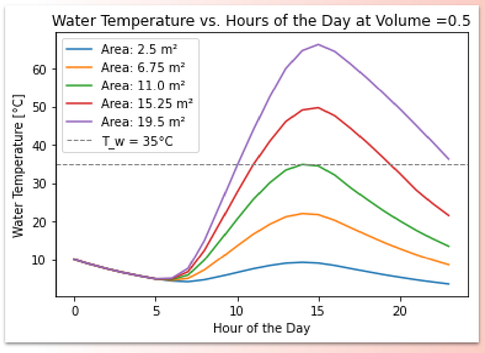


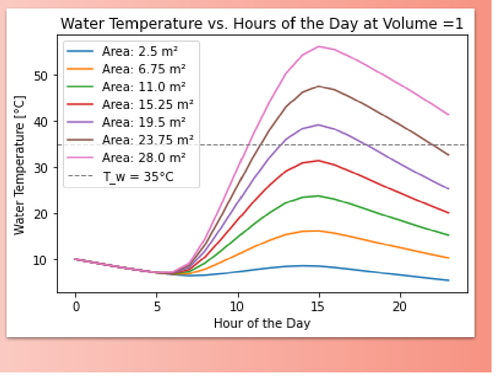
FIXED TANK VOLUME VARIABLE AREA OF COLLECTOR











Discussion about the results

- ➔The system easily meets the demand (COP = 2.3 for A = 14 m² and V = 500 l)
- ➔Financial criteria needed to choose an optimal configuration
- ➔Take into account tank heat losses
- ➔The use of average values might not be appropriate and induce uncertainties
- ➔Inertia effect : Calculations for each day over the period (winter)

REFERENCES:

[1] PVGIS

[2] Viessmann Solar Collector model

[3] Dimplex Heat Pump model

[4] Time Series of Heat Demand and Heat Pump Efficiency for Energy System Modeling