SOLAR DECATHLON EUROPE 2010

TEAM HFT STUTTGART - home
Architekturkonzept - home+
Passive cooling systems
Ventilation tower
Low energy cooling systems
Photovoltaic/thermal (PVT) collectors

Night

Solar Decathlon Europe 2010
Hydraulic schemes in summer

Summer day with reversible heat pump

Summer day with free cooling

Summer night PVT collectors and PCM ceiling

Summer night PVT collectors and heat sink tank
Control Strategy

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<th>Subsystems</th>
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<td>PCM ceiling</td>
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<td>Ventilation tower (if possible)</td>
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<td>Cross ventilation</td>
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<td>Low energy cooling system (Free cooling)</td>
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The above described system has been put in operation for the competition in Madrid. Figure 11 illustrates the temperature evolution during 2 days and 3 nights within the heat sink tank with heating phase during the day and cooling phase during the night. During the heat pump operation, the heat pump run in this configuration with a better efficiency than a classic air-cooled chiller would do. [1]

Almost 30% of the cooling loads is taken by the PCM ceiling and another 44% is distributed via the radiant floor. Furthermore, the radiative cooling system with PVT collectors in combination with the heat sink tank work very efficiently since it can cover around 45% of the cooling loads (PCM + free cooling).

The next table shows the priority and order of use of all components able to meet part of the cooling demand of the house, taking in mind, that the passive technologies will be used with the highest priority and then the technologies that require low parasitical energy will have the priority.

### Priority Subsystems

- **Radiant floor**
- **Indirect evaporative cooling**
- **PCM ceiling**
- **Ventilation tower**
- **Heat pump**
- **Free cooling**

Fig. 9: Distribution of cooling energy in the house

Fig. 10: Cooling energy distributed via the activated floor

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Temperature evolution in the heat sink tank during the competition

Power of PVT in the night of 19./20.06.2010

Mean cooling power: ca. 65 W/m²
Dissipated energy: 23,7 kWh
Pumped electrical energy: 0,81 kWh