













The combination of Dry-cooler systems and photovoltaic installations allows a saving of non-renewables sources. Furthermore, the indirect free-cooling effect results in a smaller power of photovoltaic installation, when this is designed to cover, with his production, the HVAC electrical energy requirement.

**REFERENCES**

[1] A. Boyanoa, P. Hernandez and O. Wolf, “Energy demands and potential savings in European office buildings: case studies based on EnergyPlus simulations,” *Energy and Buildings*, vol. 65, pp. 19-28, Oct. 2013.

[2] L. Perez-Lombard, J. Ortiz and C. Pout, “A review on buildings energy consumption information,” *Energy and Buildings*, vol. 40, pp. 394-398, 2008.

[3] D. Caccaveli and H. Gugerli, “TOBUS – a EU diagnosis and decision making tool for office building upgrading,” *Energy and Buildings*, vol. 34, pp. 113-119, 2002.

[4] P. Capros, L. Mantzos, V. Papandreou and N. Tasios, “*EU Energy and Transport Trends 2030 – Update 2007*,” Office for Official Publications of the EU Communities, Luxemburg, 2008.

[5] A. De Angelis, M. Medici, O. Saro, G. Lorenzini, “Evaluation of evaporative cooling system in industrial buildings” *International Journal of Heat and Technology*, vol. 33, pp. 1-10, 2015.

[6] A. De Angelis, M. Medici, O. Saro, G. Lorenzini, “Evaluation of evaporative cooling system in industrial buildings” *International Journal of Heat and Technology*, vol. 33, pp. 1-10, 2015.

[7] Energy Plus Manual.

[8] ASHRAE Fundamentals Handbook, ASHRAE, Atlanta, 2001.

[9] ASHRAE Fundamentals Handbook, ASHRAE, Atlanta, 1999.

**NOMENCLATURE**

A area  
 c specific heat, kJ. kg-1. K-1

CHDD hourly cooling degree day  
 G global solar radiation, W/m<sup>2</sup>  
 I<sub>bo</sub> direct radiation on a horizontal surface  
 I<sub>do</sub> diffused radiation on a horizontal surface  
 k thermal conductivity, W.m-1. K-1  
 P power, kW  
 Q energy, kWh  
 R<sub>b</sub> inclination factor of direct radiation  
 R<sub>d</sub> inclination factor of diffused radiation  
 R<sub>r</sub> inclination factor of scattered radiation  
 T temperature, K  
 t time, s  
 U<sub>c</sub> heat transfer coefficient, W.m-2. K-1

**Greek symbols**

α solar absorptance  
 β volume coefficient of expansion, K-1  
 Δ Interval, variation  
 ε efficiency  
 φ heat flux, W.m-2  
 η efficiency of PV cell  
 θ temperature, °C  
 τ solar transmittance

**Subscripts**

a air  
 b building  
 c cooling  
 ch chiller  
 DC dry-cooler  
 elt electrical  
 ext external  
 fc free cooling  
 FC fan-coil  
 i inlet  
 int internal  
 ml log mean  
 o outlet  
 PV photovoltaic  
 R state of reference  
 w water