A new climate indicator to be used in prediction of cooling energy in hot and humid regions

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Abstract

Cooling degree days (CDD) and cooling degree hours (CDH) are the climate correlations generally used in the models for building cooling consumption prediction. Both are calculated from the dry bulb temperature and are useful in analyses where sensible heat is predominant. In hot and humid climates, the latent heat cannot be overlooked. This study developed a new climate indicator that considers both sensible and latent heat. The annual cooling demand for a building model was obtained for twenty Brazilian cities using Energyplus®. The CDH value for each city was calculated. The enthalpy was used to obtain a climatic indicator, the CEH (cooling enthalpy hours). A linear regression analysis was conducted to evaluate the relationship between these indicators values and the annual cooling demand. The results showed that the CEH has a stronger relationship with the annual demand of cooling. The standard error reduced from 12.11 to 9.50 kWh/m^2.year and the coefficient of determination increased from 0.9428 to 0.9648. The calculations were expanded to 407 Brazilian cities confirming the good performance of the CEH, since the R^2 value remained high (0.9459) and the standard error low (11.82 kWh/m^2.year). From the CEH, eighteen climate zones were suggested to represent the Brazilian climate.

Keywords

Building prediction model; Cooling degree hours; Climate indicator; Cooling consumption.

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Biographies

Mauricio Nath Lopes is an Associate Professor at Department of Refrigeration and Air Conditioning at Federal Institute of Santa Catarina. He is a Mechanical Engineer, Master in Mechanical Engineering and PhD in Civil Engineering from Federal University of Santa Catarina (UFSC). He has published journal and conference papers. His research interests include energy efficiency in HVAC systems and building simulation.

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