Hourly Solar Radiations Predictions for Anticipatory Control of Electrically Heated Floor: Use of Online Weather Conditions Forecast

Authors : Helene Thieblemont, Fariborz Haghighat

Abstract : Energy storage systems play a crucial role in decreasing building energy consumption during peak periods and expand the use of renewable energies in buildings. To provide a high building thermal performance, the energy storage system has to be properly controlled to insure a good energy performance while maintaining a satisfactory thermal comfort for building's occupant. In the case of passive discharge storages, defining in advance the required amount of energy is required to avoid overheating in the building. Consequently, anticipatory supervisory control strategies have been developed forecasting future energy demand and production to coordinate systems. Anticipatory supervisory control strategies are based on some predictions, mainly of the weather forecast. However, if the forecasted hourly outdoor temperature may be found online with a high accuracy, solar radiations predictions are most of the time not available online. To estimate them, this paper proposes an advanced approach based on the forecast of weather conditions. Several methods to correlate hourly weather conditions forecast to real hourly solar radiations are compared. Results show that using weather conditions forecast allows estimating with an acceptable accuracy solar radiations of the next day. Moreover, this technique allows obtaining hourly data that may be used for building models. As a result, this solar radiation prediction model may help to implement model-based controller as Model Predictive Control.

Keywords : anticipatory control, model predictive control, solar radiation forecast, thermal storage
Conference Title : ICEEP 2017 : International Conference on Energy Economics and Policy
Conference Location : San Francisco, United States
Conference Dates : June 07-08, 2017