Thermal Dynamic Model and Analysis of Heating Buildings

Q. Wang\textsuperscript{1}, T. Ren\textsuperscript{1}, Y. Sun\textsuperscript{2}, Y. Xue*\textsuperscript{1}, W. Fei\textsuperscript{3}, X. Wang\textsuperscript{4}

\textsuperscript{1}Tsinghua University, China
\textsuperscript{2}State Grid Jilin Electric Power Company, Changchun, Jilin, China, China
\textsuperscript{3}Changchun City Heating(Group) Co., LTD, China
\textsuperscript{4}Beijing Huajian Wangyuan Power Design Institute, China

Abstract

Northeast China has rich wind resources, while in the area where residential heating supply is mainly provided by combined heat and power (CHP) units, the curtailment of wind power is a serious problem in winter since the peak regulation capacity of CHP units is restricted by the demand for heat. The urban district heating (DH) system and residential buildings have huge heat storage capacities. To take full advantage of their heat storage capacity to improve the operational flexibility of CHP units, this paper explored the thermal dynamic of residential buildings. Basing on that, it explored the feasibility of regulating CHP units to increase the wind power integration. A first principle dynamic model of residential building was built in sub-station level of DH system, and then field test data of two districts in Changchun city were used to verify this model. The results showed that the model could simulate the dynamic of indoor temperature of buildings quite well when the heat supply and outdoor temperature changed. The influence of various heating supply scheduling modes on indoor temperature was finally compared basing on this model under typical outdoor temperature of winter. The results demonstrate the feasibility of future optimal scheduling of CHP units basing on thermal characteristics of residential buildings.