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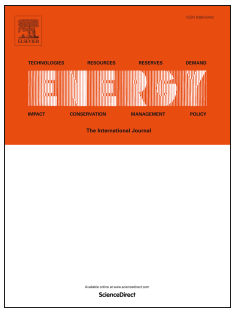

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Model Predictive Control for a Solar Assisted Ground Source Heat Pump System

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Abstract

There has been an increased interest in cost and energy efficiency for heating, ventilation, and air conditioning systems for buildings since these are responsible for between 25% and 40% of total building energy demand. Solar assisted ground source heat pump systems which combine solar and geothermal energy are gaining attention due to their higher efficiency and greater functional diversity when compared with conventional systems. This paper presents a mixed integer linear programming approach to minimize the operational cost of a solar assisted ground source heat pump system, considering time-of-use electricity price (peak, off peak). Two types of system configurations are investigated in order to examine the effect of thermal storage in the system. Two different objectives are explored: minimizing electricity consumption and operational cost. The results indicate that the system having integrated thermal storage leads to improved peak shaving, which reduces the need for expensive peak electricity production for the grid, and has a reduction of operating cost by 7.8% when it is optimized for minimal cost.

Keywords: Ground source heat pump, Heat storage, Solar thermal, Model predictive control, Mixed integer linear programming

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