



Contribution ID: 238

Type: Poster Presentation

Air Source Heat Pump Water Heater: PID Controller Based Control System and Optimal Energy Management

Wednesday, 6 July 2016 16:10 (1h 50m)

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Sanitary hot water production remains the principal issue to address in a typical residential house where electrical geysers still account for up to 45% of the total electrical energy consumption. Air source heat pump water heater could offer a permanent solution for water heating as it consumes 67% less amount of the energy use by a geyser for an identical heating load and operates at a COP of over 200% year round. But yet, air source heat pump (ASHP) water heater used in South Africa still present some possibilities for further system's optimization in a bid to achieve a higher operation efficiency from an energy management perspective.

In this work, we present a MATLAB simulation of an ASHP water heater unit that incorporates a PID controller using ambient temperature feedback to adjust the speed of an inverter controlled variable speed compressor. A fan speed calibration curve is also determined that maps wind speed to the speed of the fan so as to reduce its energy consumption during minimal load. The simulation reveals a drop in power consumption of close to 8% during an average summer day and over 15% during a very sunny and windy day.

Keywords: Air source heat pump water heater, PID controller, variable speed compressor, capacity control and fan speed control.

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yes

Level for award (Hons, MSc, PhD, N/A)?

MSc

Main supervisor (name and email) and his / her institution

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Session Classification: Poster Session (2)

Track Classification: Track F - Applied Physics