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Modeling and real time simulation of instantaneous performance of residential air source heat pump water heater.

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Abstract :

Air source heat pump on like water and geothermal source heat pumps are widely used in sanitary hot water production by virtue of the relative ease of harvesting low grade aero-thermal energy and less complexity in operating and maintaining the heat pump unit. The optimization of power and coefficient of performance of the system require a detail and crucial investigation of compressor, condenser, evaporator, expansion valve and thermo physical properties of the refrigerant to ensure components are under steady state condition for their optimal performance when system is in operational heating mode. It is worth mentioning that this approach for optimizing system is challenging and time consuming. Hence this paper appraises identifying primary and secondary predictors of the system performance and these variables were employed to develop a multiple linear regression model of the power and COP. Since our goal was to develop a robust model, an optimization of the input variables was performed using constrained linear least square solver in matlab optimization tool. Furthermore, a data acquisition system was designed and built to measure ambient temperature, relative humidity, condenser, evaporator, inlet cold water and outlet hot water temperatures of the ASHP. In addition, electrical power of ASHP and its water flow rate were also measured while system was in heating up cycle. The results showed that COP depends primarily on volume of water heated, temperature of cold water and hot water from the ASPH while the influence of ambient temperature and relative humidity were secondary. The predictors were ranked by weight importance using a function reliefF in matlab statistical tool. We , concluded by designing a simulation using the mathematical model which can be used by manufacturers of residential ASHP and energy saving company to determine performance and energy savings.

Award :

yes

Level :

MSc

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Paper :

Yes

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