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Use of Passive Cooling for the Improvement of Coefficient of Performance of Small Scale Conventional Air Conditioners

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Globally demand for energy increases, and there are many attempts to reduce energy consumption from air conditioning. At present, around 15% of total global energy is consumed by buildings and out of that, nearly 50% of energy is accounted by the air conditioning systems. Therefore this research focused on a novel system to improve the coefficient of performance (COP) of conventional compression-based air conditioning systems by the use of passive cooling. The technique involves condenser passive cooling in order to lower the condenser temperature, with the objective of increasing the efficiency of the system. Condensate water recovered at the evaporator was sent via a pipe heat exchanger across which condenser cooling air is drawn using the regular condenser cooling fan. This results in reduced compressor work and improved cooling. Based on this concept, theoretical calculations were conducted and it was found out that around 10% of overall energy saving can be achieved. The system was implemented on a real air conditioner having 1 ton capacity and a series of experiments were conducted to find the overall compressor off times indicating a direct energy saving. It was found out that in agreement with the theoretical calculations, the experiments also produced from 5%-10% of energy consumption reduction when the evaporator temperature was set around 25 °C. This concept is fundamentally applicable for any air conditioning system running on compression refrigeration. In future this system needs to be further improved in order to be applicable for different capacities and designs of air conditioning systems which are available in the market.

Key words: air conditioning, coefficient of performance, condenser cooling, improvement of COP of air conditioners, passive cooling