

## **Theoretical performance evaluation of R600a and R134a refrigerant based variable speed DC compressors for solar based cold storage applications**

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### **Abstract**

The theoretical performance evolution of R600a and R134a refrigerant based DC compressors are simulated for different compressor speeds (2000 rpm, 2500 rpm, 3000 rpm and 3500 rpm) using the data collected for Chennai, from NREL for the period of one year and simulated based on the hourly average solar irradiance, ambient temperature and wind speed. Based on the simulation results it can be implied that during a cloudy day, R600a can produce cooling energy significantly greater than R134a, whereas for a sunny day, the average cooling energy for R134a is slightly greater than R600a. Considering the daily average of various parameters for a year, if the speed of the compressor is increased from 2000 to 3500 rpm, the operating time per day decreased from 8.45 to 6 hours for R600a and 7.88 to 5 hours for R134a. Consequently, the ice formation and system energy utilisation efficiency for R600a increased from 7.13 to 8.29 kg and 11.7% to 13.6% but for R134a it increased from 7.44 to 8.33 kg and 12.2% to 13.7% and decreased after 3000 rpm. At maximum speed of 3500 rpm, R600a compressor has more annual operating time of 2216 hours (20.4% more than that of R134a) and total cooling energy production of 1014 MJ (4.4% greater than R134a). Thus, for solar based cold storage applications R600a refrigerant based DC compressor is much suitable for Chennai climatic condition.