A Simple De-Humidification System

Background:

The process in which the moisture or water vapour or the humidity is removed from the air keeping its dry bulb (DB) temperature constant is called as the dehumidification process. This process is represented by a straight vertical line on the psychrometric chart starting from the initial value of relative humidity, extending downwards and ending at the final value of the relative humidity. Like the pure humidification process, in actual practice the pure dehumidification process is not possible, since the dehumidification is always accompanied by cooling or heating of the air. Dehumidification process along with cooling or heating is used in number of air conditioning applications.

Relative humidity in dwellings should preferably range from 30 to 50%. Dehumidifiers reduce humidity levels, making a room less hospitable to allergens such as dust mites, mold, and mildew.

Dehumidifiers are used in industrial climatic chambers, to reduce relative humidity and the dew point in many industrial applications from waste and fresh water treatment plants to indoor grow rooms where the control of moisture is essential.

Description of flowsheet:

The feed enters at a flowrate of 3600kg/h and a relative humidity of 68% at 100kPa pressure and 20 degree Celsius temperature. This feed air enters the compressor which increases the pressure to 275kPa. Now the compressed air is cooled to 20 degree Celsius temperature using a cooler. This cooled air is passed on to a gas liquid separator where the condensed water can be separated. The gas-liquid separator separates the condensed liquid which is at a flowrate of 16.85kg/h. The top product of the gas-liquid separator is depressurised to 100kPa using a valve. The product obtained from the valve is the dehumidified air which is having a relative humidity of 36.3%.

Results:

1) Dehumidified air is obtained at 36.3% relative humidity.
2) The compressor requires 62.781kW of energy
3) The cooler gives out 74.263kW of energy.

Conclusions:

1) This process gives a net output of 11.482kW energy which can be used for other processes.
2) The more we compress the inlet air, higher amount of water is condensed which gives higher degree of dehumidification.

Reference:

http://www.dehumidifierbuyersguide.com/how-dehumidifiers-and-air-conditioners-work