Humidity Control Applications

Flakt Dryers

Airborne Dryer

Humidity Control - Pulp and Paper

Humidity control can help to optimize the performance of the hot air / direct contact drying processes used in the pulp and paper industry. These processes include Yankee Hoods and Through Air Dryers used in tissue manufacturing and Air Float dryers and Flash Dryers used to dry pulp. Humidity control has the potential to improve their thermal efficiency, sheet moisture control, and can assist in process diagnostics.

In the past, a fundamental impediment to success has been sensor accuracy and reliability in high temperature/particulate exhaust streams. Our recent experiences with the *Dewcon Humidity* sensor have been very positive.

Dewcon Sensor
Standard Unit

Accurate and reliable in high temperature, dirty exhaust streams

Dewcon Sensor – Principle of Operation
Dipole Measurement

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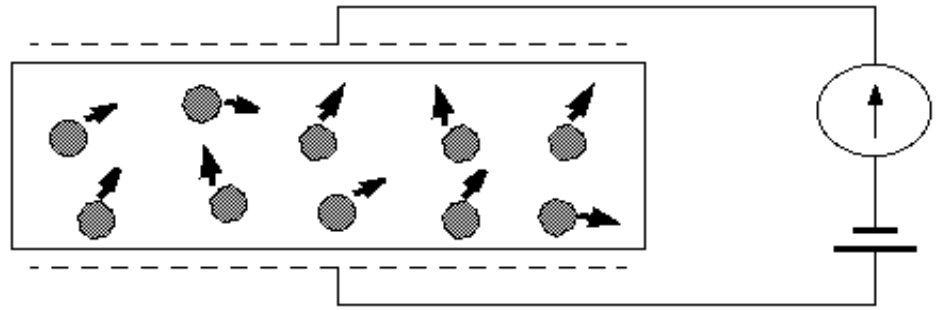
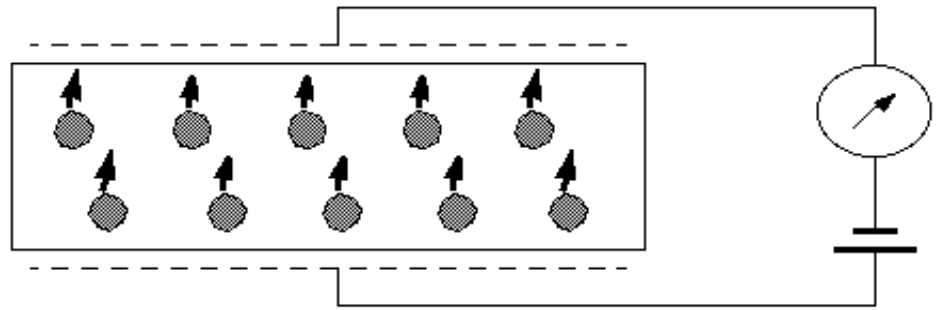
Dipole–Frequency Theory of Measurement –2



Dipole Polarization

- *degree of alignment depends on temperature and electric field energy*
- *at known temperature, number of polar molecules* α *energy consumed by electric field*



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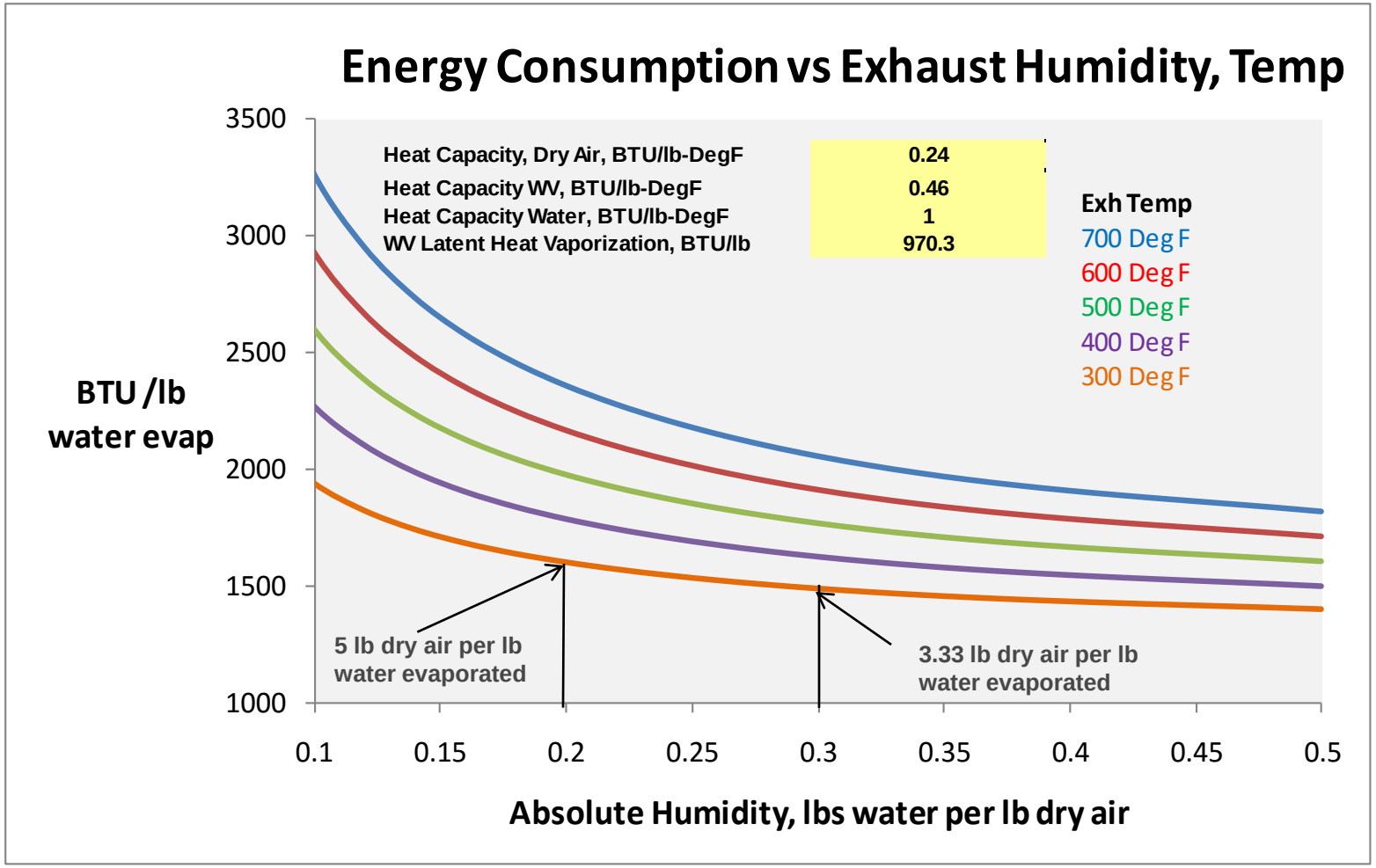
Conference of Food Engineering (COFE), AIChE Annual Meeting, Los Angeles, 1997

Humidity Control
Impact on Thermal Efficiency

The exhaust humidity is one of the most important factors determining dryer thermal efficiency. Increasing the exhaust humidity reduces the dry air flowrate into/out of the dryer. The energy required to heat up dry air to the exhaust temperature is reduced proportionately.

In the majority of dryers, the dry air feed-rate is maintained relatively constant over the entire operating range. The Makeup Air/ Exhaust Air damper positions are rarely adjusted. This approach means that the exhaust humidity will vary with the evaporation rate. At high production rates the evaporation rate is high (achieved by increasing the drying air temperature) and the exhaust humidity will also be high. The reverse is also true. If the production rate is constant but the incoming sheet moisture content decreases, the evaporation rate will decrease and the exhaust humidity will decrease. In most mills, the makeup and exhaust damper positions are set conservatively and the average humidity is substantially lower than necessary.

Energy Consumption vs Humidity
Hot Air drying processes

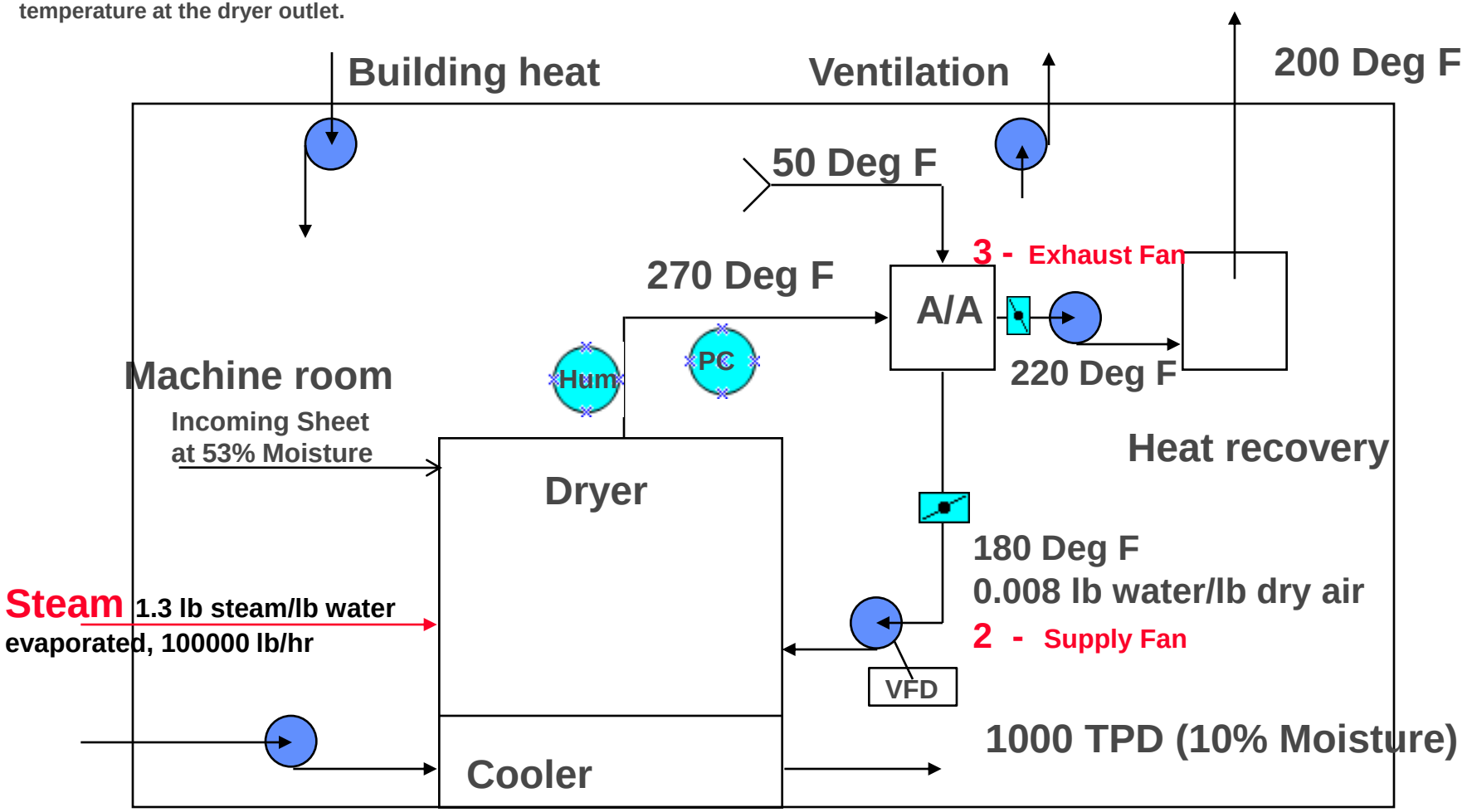


Flakt Dryer – Typical Air Balance 1000 ADTPD Production

The dryer should be in balance: slight infiltration at the bottom of the box and slight pressure at the top.

Fans 2 and 3 should be in balance, and set to give a 160 Deg F wet bulb temperature at the dryer outlet.

200 Deg F
920 TPD Water
4610 TPD Dry Air
0.2 lb water/lb dry air



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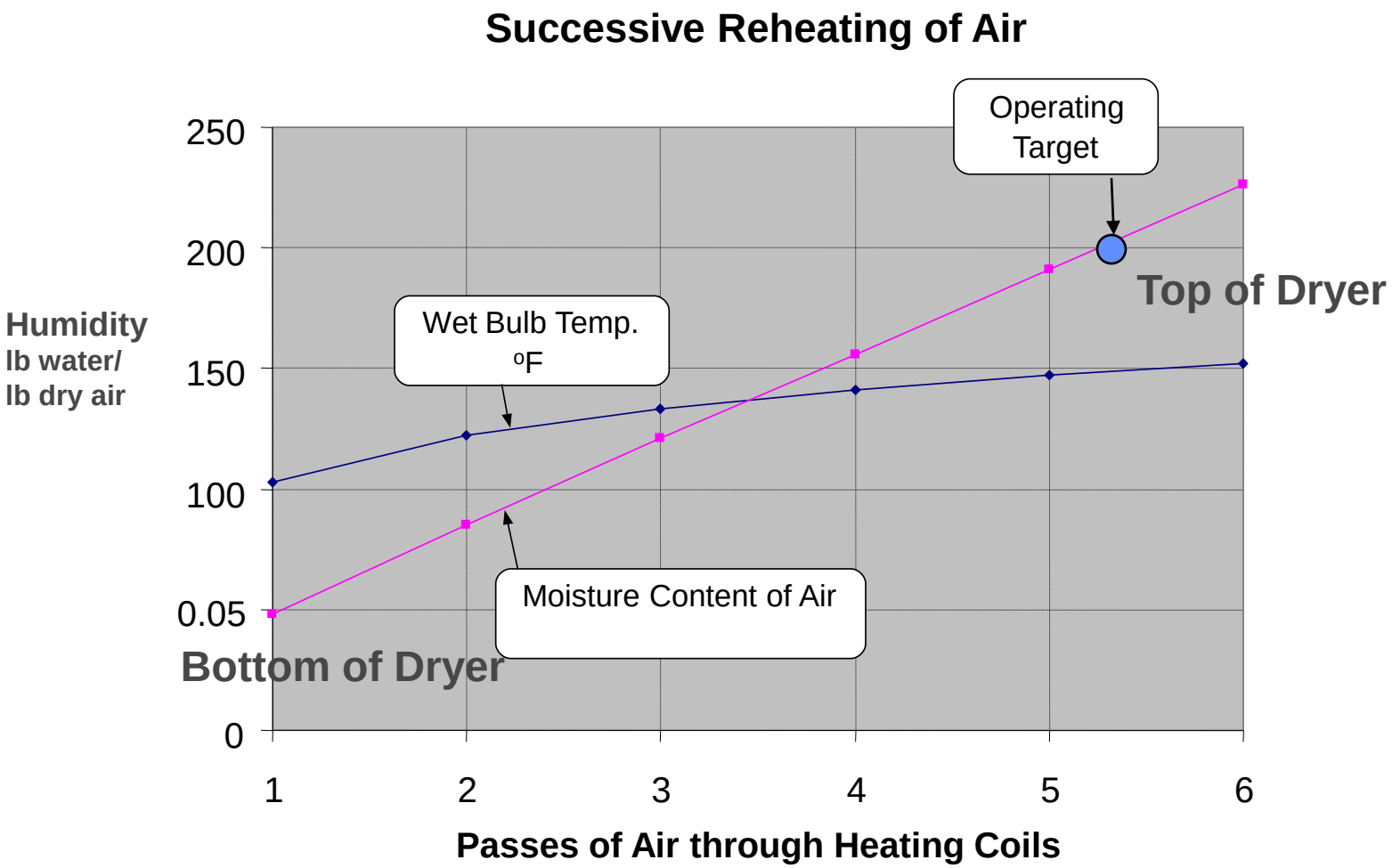
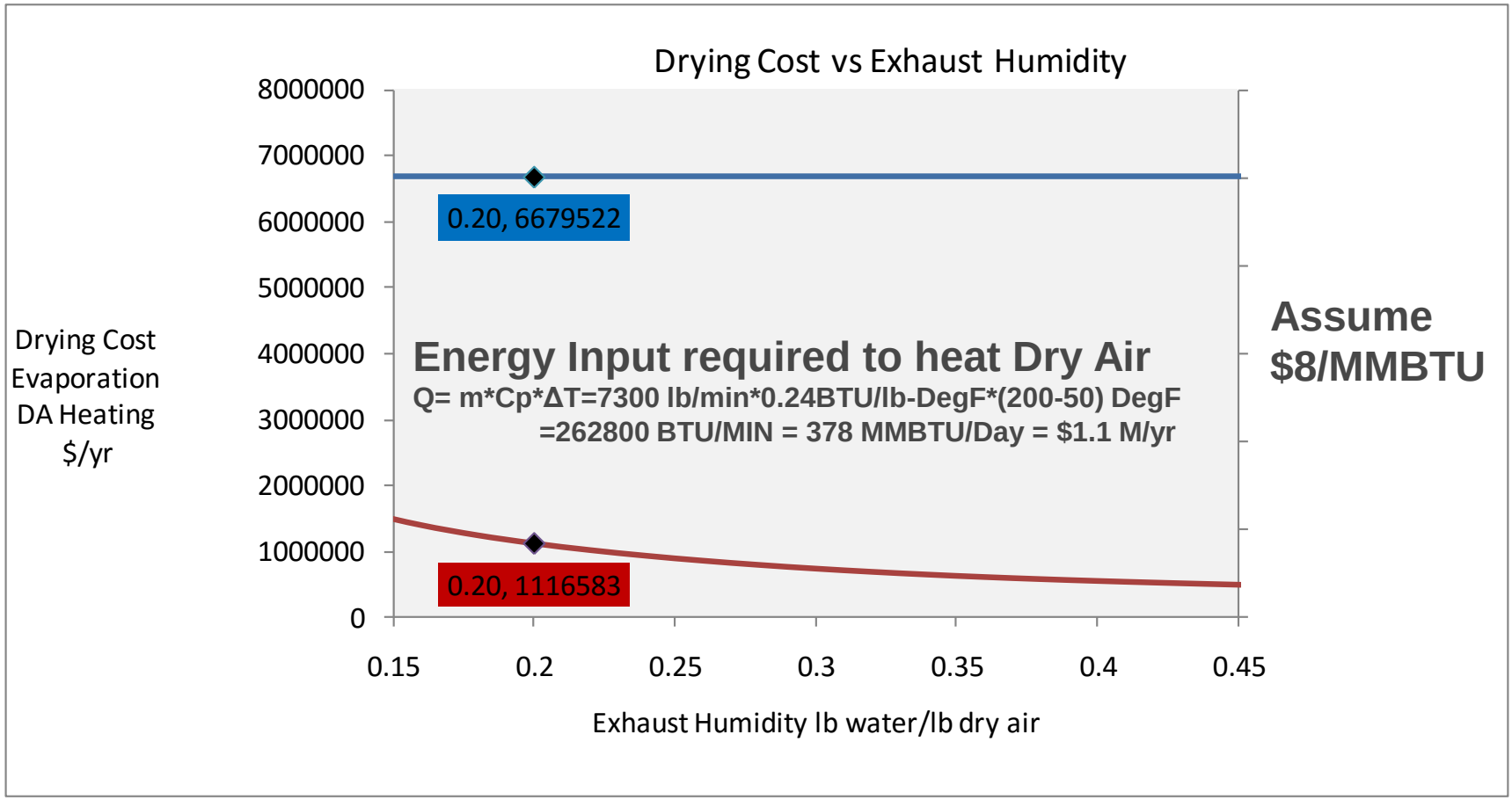
Flakt Dryer – Humidity Control

- Humidity controller to adjust Supply Fan Damper or VFD
- Discharge Pressure controller to adjust Exhaust Fan Damper
- A primary disturbance to exhaust Humidity is incoming sheet moisture. An increase in the sheet moisture content will increase dryer exhaust humidity. The Humidity controller will increase Supply Fan Flowrate and the Discharge pressure controller will increase Exhaust Air Flowrate.
- The Humidity sensor can be used as a feedforward signal to adjust energy input (steam pressure) to the dryer.

Flakt Dryer
Multiple Pass Heating



Energy Cost
0.2 lb water/lb da in exhaust



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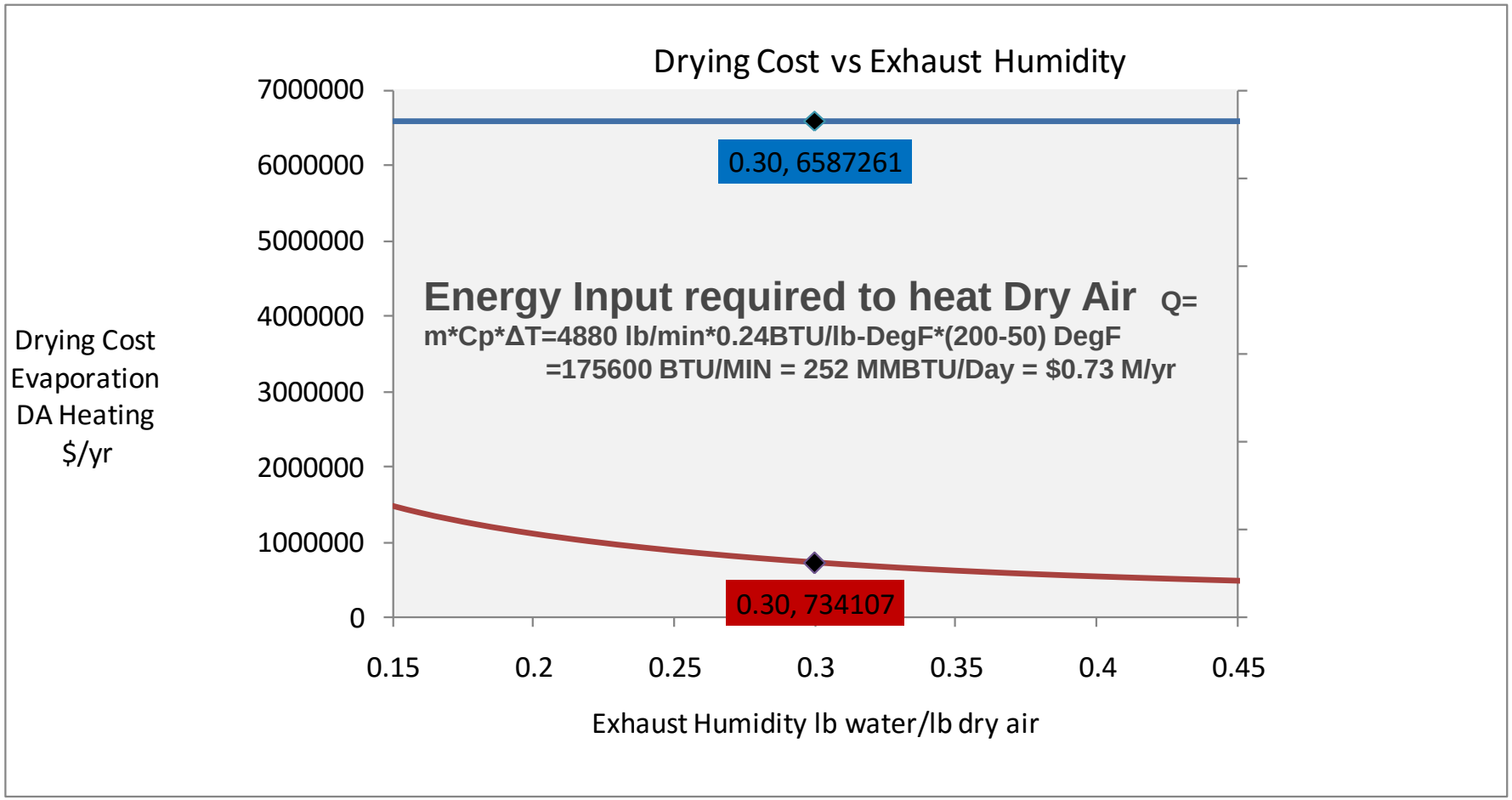
Energy Cost
0.3 lb water/lb da in exhaust



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Flakt Dryer – Humidity Control

- The Dewcon humidity sensor can help to optimize Flakt Dryers
- The potential energy savings is significant and can easily justify the cost of the sensor (approx $25000)
- The exhaust humidity is an indication of the evaporation load, and can be used to signal changes in the sheet moisture content at the dryer inlet.
- The humidity sensor can be an important diagnostic tool for operators and engineers.