

## Caldwell Energy Relies on Vaisala HMT333 Humidity and Temperature Transmitters for Turbine Inlet Air Cooling Systems

*Power plant turbines intake large amounts of air that needs to be cooled and filtered for the turbines to operate at maximum efficiency for power generation. To achieve proper air cooling, power plants around the world rely on the expertise of Caldwell Energy, a global provider of turbine inlet cooling technologies, including evaporative cooling wet compression, chilling, and thermal energy storage.*

### Thermal Dynamics of Inlet Air

Cooler, denser air allows a greater mass of air flowing through the turbine, resulting in increased power generation. In contrast, warmer, less dense air decreases the mass of air flowing through the turbine, significantly decreasing power output and increasing the cost to operate the turbine. Caldwell Energy's PowerFog® Evaporative Inlet Air Cooling Technology is often applied in hot, dry climates where the evaporative cooling is most effective.

### Evaporative Cooling by Fogging

Caldwell's PowerFog technology cools the inlet air by creating a fine evaporative mist. To determine the amount of water needed to achieve the cooling effect for the atmospheric conditions, fogging technology depends on accurate and reliable temperature and humidity monitoring. Adding too much water could create larger water droplets which could cause turbine blade erosion or damage. Adding too little water will not cool the air enough to keep the turbines performing at peak efficiency.



### Challenge

- Reliable operation in an industrial environment
- Optimal cooling and turbine operation depend on accurate humidity and temperature measurements
- 24/7 industrial operations where condensation and chemicals can affect accuracy

### Solution

- Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330
- Heated probe, chemical purge function, and Vaisala HUMICAP® thin-film polymer technology ensure highly accurate humidity measurement in industrial environments

### Benefits

- Built for the industrial environment
- Reliable sensor that provides operation with no instrument failure
- Easy to service

*"Vaisala's are built for the industrial environment. We've had no failures in six years."*

*Mark Ammons, Project Engineer,  
Caldwell Energy*

## Designed for the Industrial Environment

In industrial applications reliable humidity and temperature measurements can be affected by environmental conditions, including condensation and contaminants. Caldwell required a device that was designed for reliability, accuracy, and low maintenance in power generation environments.

## Accurate Wet-bulb Temperature

Accurate wet bulb measurement is particularly important to efficient

fogging. Evaporative cooling is effective as long as the water can vaporize into the air. Once a combination of relative humidity, water vapor saturation pressure, and temperature reach a point where liquid water cannot vaporize into the air, the benefits of evaporative cooling cease. This is the wet bulb temperature. Since foggers can only cool to this point, accurate outdoor wet bulb temperature measurement is critical to optimal operation and not running the fogger when cooling is not possible. Overrunning evaporative cooling equipment increases energy use, water use, and equipment maintenance costs with no added benefit to turbine performance.

## Continuous, Automated Monitoring

To achieve the optimal mix of air and water to create a cooling mist, Caldwell uses a Vaisala HMT333 HUMICAP® Humidity and Temperature Transmitter located near the inlet to continuously monitor the outdoor dry-bulb

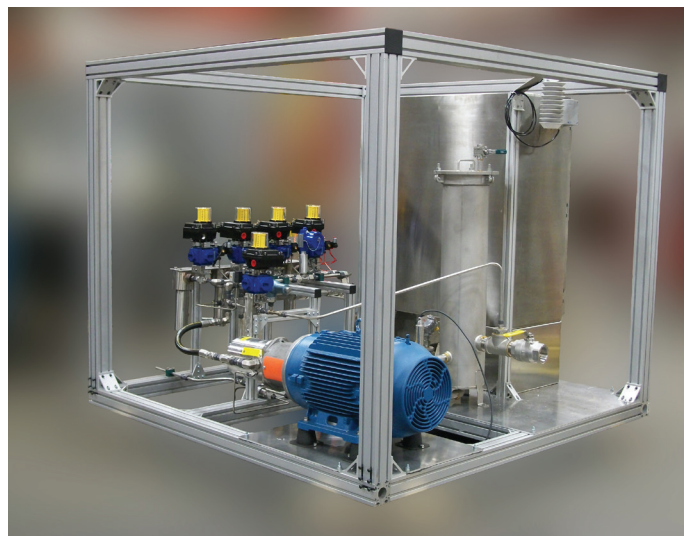
temperature and the outdoor wet-bulb temperature. Vaisala's HUMICAP sensing technology provides accurate and stable measurement in environments with high humidity and chemical contaminants. Caldwell also uses the HMT337 which is equipped with a heated probe to prevent condensation on the sensor itself for superior performance in condensing environments. A chemical purge feature also minimizes effects of contaminants on measurement accuracy.

Installation depends on system design, but Caldwell typically installs the units on the SCADA control cabinet or near the inlet duct. The transmitter is linked to the system's controller to automate operations.

Along with the HMT333, Caldwell uses the Vaisala Radiation Shield Series DTR500 to protect the HMT333's humidity and temperature probes from solar radiation and precipitation which can cause measurement errors in both the dry bulb and wet bulb readings thereby ensuring the greatest measurement accuracy.



*Vaisala HMT330 Series Humidity and Temperature Transmitters*



*Caldwell Energy's PowerFog® evaporative inlet air cooling system for combustion turbines.*

# VAISALA

For more information, visit  
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