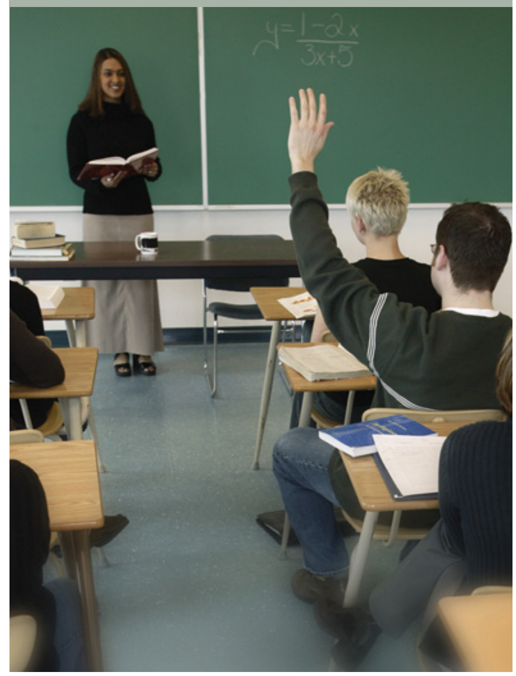
CASE STUDY:
Western Nevada
Community College (WNCC)



Munters Oasis™ DX provides savings out of thin air

Founded in 1971, the Western Nevada Community College (WNCC) is a public two-year community college serving the people of the seven western counties of the Silver State. The most interesting HVAC lesson on campus is the college's new 70,000-sq-ft classroom and laboratory complex, located at 5,100-ft elevation on the edge of the beautiful Sierra Nevada Mountain range. The three-story complex, which overlooks the state capitol in Carson City, uses a 50°F VAV supply air design with two-stage evaporative cooling. This system reduces summer design day refrigeration by 56%, while furnishing 100% outdoor air to the students and professors.

First Things First

First cost for Munters' Oasis™ air cooled, direct expansion (DX) VAV system employing three rooftop heat pipe indirect-direct evaporative cooling systems was compared to a central plant design with roof mounted VAV units connected to a water cooled chiller.

The central plant system could provide free cooling when ambient wetbulb temperatures are low enough to develop the required 53°F chilled water supply used during mild weather. However, during warmer ambient conditions, a chiller supply water temperature of 44°F would be required.

The Oasis™, all-outdoor air design would employ "pinchdown" VAV boxes, set for a maximum 50% turndown, with hot water reheat. During the heating mode, the pinch down boxes would be set in the minimum-flow position.

D. Bruce Nipp, P.E. (left), project manager and mechanical engineer for the State of Nevada Public Works, and Arnold Etchemendy, project manager for Petty and Associates, the engineer on the project, stand in front Western Nevada Community College.

BENEFITS

- 100% outdoor air
- Two stage evaporative cooling
- Energy efficient summer cooling
- Humidification option for cold dry winters
- Winter pre-heat
- Exceeds ASHRAE Standard 62

Munters

Five Degrees of Separation

The decision to proceed with the Oasis™ raised some additional comfort issues. When indirect-direct evaporative cooling systems have been installed in dry climates without any refrigeration as a final stage of cooling, building occupants have complained of high indoor humidity. Taking into consideration comfortable RH levels for those that reside in dry climates, it was decided to place the VAV supply air setpoint at 50°F in the summer, which would result in a space RH of approximately 40% to 45% at 75°F.

Cool Bonus

An additional benefit of selecting a lower VAV design temperature is realized in winter, when VAV systems typically are at their minimum cfm flow settings. The heat pipe air-to-air heat exchanger provides enough pre-heating so that the outdoor air dampers and return air dampers can position themselves to introduce 76% outdoor air. The higher ventilation rate exceeds ASHRAE Standard 62. That excess ventilation may be provided without added energy costs to the owner during the cooler outdoor temperatures.

A second control option in winter is to overheat the outdoor air and use the 4-inch deep section of the wetted media, direct evaporative cooler to add beneficial humidification during the dry winter season, all the while maintaining the required 50°F supply air setpoint. This humidification is furnished without cost to the building owner, since waste heat in the exhaust air from the building is used to evaporate the water for humidity control.

Lighter Load, Less Often

Using Typical Meteorological Year (TMY) data for Reno, NV, Figure 1 illustrates the month by month ton-hour refrigeration cooling requirements per 1,000 cfm of the Oasis™ compared to the more conventional air handling unit system, with an air-side economizer introducing a maximum of 30% outdoor air on a design day. Based on furnishing 50°F supply air, it is clear that the all outdoor air design using evaporative cooling allows the owner to put his/her refrigeration system to bed earlier in the fall, and not disturb it again until late in the spring. More significant is the 78.7% reduction in the yearly refrigeration ton-hour cooling requirement when two-stage evaporative cooling is employed (See Figure 1 above).

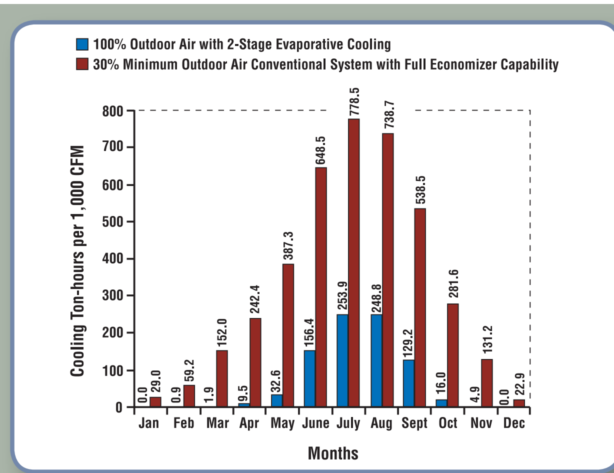


Figure 1: Using Typical Meteorological Year (TMY) data, this chart compares monthly ton-hours of cooling for this facility, considering both evaporative cooling and conventional designs. The supply air requirement is 50°F; fan heat is included. The duty cycle for both systems is 7 a.m. to 7 p.m., six days a week.

An Oasis™ DX unit installed on the WNCC's classroom and laboratory complex.

Getting to "The Point"

A review of the hour-by-hour drybulb and wetbulb TMY data for Reno shows an August 2, 4 p.m. design dewpoint condition of 81°F db (drybulb) and 64°F wb (wetbulb). At 5,000-ft elevation, this equates to a high dewpoint of 56°F. A dewpoint design of 123 tons was calculated. After indirect (dry) evaporative cooling, the condition of the outdoor air entering the DX cooling coils would be 74.3°F db and 62.0°F wb, which includes fan heat.

The refrigeration air-cooled condensing units are not affected by high ambient humidity, but their energy consumption is significantly reduced by approximately 110 kW, or 0.65 kW/ton when operating at 81°F db, as opposed to the 96°F summer design.

Conclusion

While the ASHRAE Standard 62 committee is considering reducing classroom outdoor ventilation rates by 40% compared to current Standard 62, dry western climates can actually increase the cfm per student outdoor air rates above 15 cfm, while reducing peak refrigeration demand in summer months.

In winter, a heat pipe economizer will also open up outdoor air dampers on VAV systems, allowing ASHRAE Standard 62 compliance without thermal penalty to the owner. With electric utility deregulation imminent, this two-stage evaporative cooling design concept can reduce peak summer cooling demand by more than 50%, helping level the building's electric demand profile for high-occupancy applications, such as schools.

Munters Corporation
Tel: (800) 843-5360
E-mail: dhinfo@munters.com
www.munters.us

Munters