The Perfect Economizer

I want to congratulate David Sellers, P.E., Member ASHRAE, on an excellent column, “The Perfect Economizer,” in the April 20222 *ASHRAE Journal* on airside economizers and the identification of system malfunctions that can lead to energy waste rather than recovery during winter variable air volume (VAV) supply fan operation.

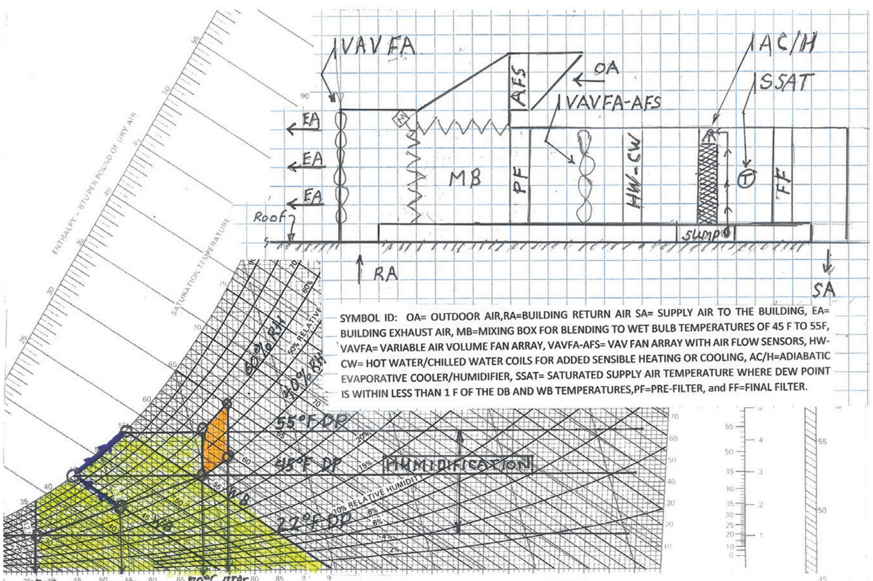
You are quite correct in identifying accurate mixed air temperature measurement as a leading contributor to lost energy savings in economizer systems, especially mixed air wet bulb (WB) and dew point (DP) temperatures.

The ASHRAE Epidemic Task Force has published a list of best practices that HVAC designers may follow to mitigate the risk of spread of airborne pathogens in infectious aerosols indoors such as COVID-19. Indoor relative humidity (RH) should be maintained between 40% to 60% to reduce the spread of airborne pathogens indoors, within the human breathing zone, during cold and dry ambient conditions.

Has your team installed and tested a WB airside economizer using a high saturation efficiency (97% to 99% RH) rigid media adiabatic evaporative cooler/humidifier (AC/H) to mix building return air with outdoor air to produce a supply air dew point that ranges between 45°F DP to 55°F DP during cold and dry ambient conditions (see my hand-drawn figure below)? The psychrometric chart shows a VAV system at 50% fan turndown with an assumed minimum 25% outdoor air to meet code ventilation requirements. The high saturation efficiency, at fan turndown to 50% flow, ensures that the delivery DB temperature off the AC/H is within a fraction of 1°F of both the WB and DP temperatures at the saturation curve. A low-cost commercial-grade DB sensor may be used with acceptable accuracy in determining the delivery DP condition of the supply air. Parasitic losses for this economizer are quite low with a static pressure loss at full flow of 0.2 in. w.g. and a water recirculation pump sized under 1.5 HP. Both the chiller and boiler are off, in the Portland Ore., climate zone for 67.4% of the annual hours of the year (yellow shaded area on the psychrometric chart), while room conditions are maintained between 40% RH and 55% RH at comfortable room air temperatures (see room target in orange shaded area). In your Portland climate, only 6% of the annual ambient conditions (below 37°F DB) would require preheating.

A 1980 Bin Weather Data reference was used to predict the Portland climate performance. Perhaps your team has more current TMY2 hour by hour ambient weather data that might more accurately reflect the effects of global warming in your area. If you do, would you be willing to share those numbers with your readers?

Mike Scofield, P.E., Fellow ASHRAE,
Sebastopol, California



A wet-bulb economizer for VAV systems with ceiling-mounted high induction diffusers and pinch down VAV terminals that include reheat and airflow measuring stations.

The Author Responds

I suspect folks with a health-care background were not surprised to see ASHRAE suggest designers consider maintaining relative humidities in the 40% to 60% range in the “ASHRAE Position Document on Infectious Aerosols” (https://tinyurl.com/2nd3t7p5). In that context, I suspect the system configuration you suggest may merit consideration as long as due consideration was given to the application issues the committee mentions in the *Journal’s* May 2021 IEQ Applications column (“ASHRAE Epidemic Task Force Core Recommendations: Reducing Airborne Infectious Aerosol Exposure,” https://tinyurl.

com/ASHRAEEndemicCorRec), along with the water consumed, the preheat energy required to address the humidification latent load and perhaps ultraviolet (UV) sterilization for the system.

Personally, I have not seen the specific configuration you illustrate applied in the Portland area. I did work with some 100% OA systems that used direct/indirect evaporative cooling in a Seattle project a while back.

The systems were applied to mitigate the solar load associated with a 20-story glass atrium and worked well. But there was an interesting "lesson learned." The contrast between the environment in the rest of the facility—served by low temperature air systems—and the areas served by the evaporatively cooled systems generated a lot of occupant complaints even though the space temperatures were within a degree Fahrenheit or less of each other.

Early in my career, I saw sprayed chilled water coils in a mushroom farm and chilled water air washers in a paper products plant, both of which are similar concepts. In those cases, the system configuration was driven by process requirements rather than infection control.

A quick survey of the folks in our company reveals that we are seeing systems configured in a manner like what you suggest serving automotive paint booths, server rooms and museums. All the applications were driven by the nature of the load rather than infection control.

Your final question is a great segue into an upcoming column. In it, I will explore/contrast the various normalized data sets commonly used for energy modeling as well as real time weather data. I have posted spreadsheets contrasting TMY2, TMY3, satellite-based TMY, and real time weather data for several sites—including Portland—on our commissioning resources website to support the column. You can find them at this link; https://tinyurl.com/TMIAboutTMY. Feel free to reach out to me if you have any questions, and thanks much for your comments.

David Sellers, P.E., Member ASHRAE, Portland, Ore.