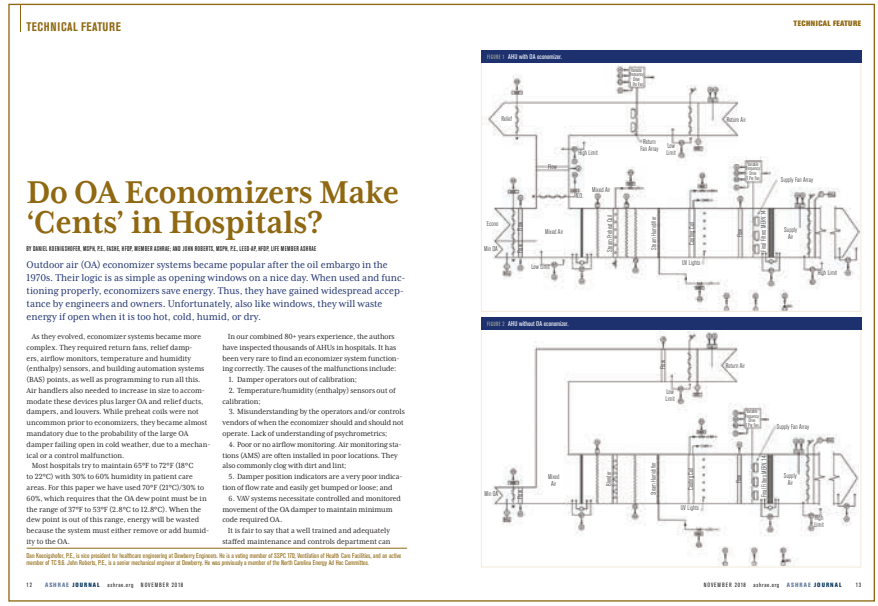
Do OA Economizers Make 'Cents' In Hospitals?

The article that appeared in the November *ASHRAE Journal* on "Do OA Economizers Make 'Cents' in Hospitals?" by Dan Koenigshofer was spot-on with regard to its assessment on the economic merits of airside "free-cooling" systems as applied in healthcare environments.

Taking Dan's analysis one step further, if simultaneous cooling/heating opportunities are identified and a heat-recovery chiller implemented to help satisfy these demands, even larger life-cycle advantages can be achieved. Turning off air (or water) side economizers and turning on the chiller to both cool and heat the building can be up to 40% more cost-effective than operating on free-cooling in the winter.

Other advantages include the reduction or elimination of cooling tower energy/water/chemical use, reductions in boiler gas consumption and GHG emissions, and drastically decreasing the amount of humidification that must be produced to properly hydrate large quantities of dry outdoor air. Chiller heat recovery will also contribute to cutting energy costs directly attributed to reheat, which can consume up to 60% of a typical hospitals natural gas use.

As a side benefit, important space air pressurization requirements can be left in-check as the air-handling system can operate at its minimum OA settings all year long.



TECHNICAL FEATURE

Do OA Economizers Make 'Cents' in Hospitals?

BY DANIEL KOENIGSHOFER, MSPH, PE, FASHE, AFSP, MEMBER ASHRAE; AND JOHN ROBERTS, MSPE, PE, LEED AP, AFSP, LIFE MEMBER ASHRAE

Outdoor air (OA) economizer systems became popular after the oil embargo in the 1970s. Their logic is as simple as opening windows on a nice day. When used and functioning properly, economizers save energy. Thus, they have gained widespread acceptance by engineers and owners. Unfortunately, also like windows, they will waste energy if open when it is too hot, cold, humid, or dry.

As they evolved, economizer systems became more complex. They required return fans, relief dampers, airflow monitors, temperature and humidity (enthalpy) sensors, and building automation systems (BAS) points, as well as programming to run all this. Air handlers also needed to increase in size to accommodate these devices plus larger OA and relief ducts, dampers, and louvers. While preheat coils were not uncommon prior to economizers, they became almost mandatory due to the probability of the large OA damper failing open in cold weather, due to a mechanical or a control malfunction.

Most hospitals try to maintain 65°F to 72°F (18°C to 22°C) with 30% to 60% humidity in patient care areas. For this paper we have used 70°F (21°C)/30% to 60%, which requires that the OA dew point must be in the range of 37°F to 53°F (2.8°C to 12.8°C). When the dew point is out of this range, energy will be wasted because the system must either remove or add humidity to the OA.

In our combined 80+ years experience, the authors have inspected thousands of AHUs in hospitals. It has been very rare to find an economizer system functioning correctly. The causes of the malfunctions include:

1. Damper operators out of calibration;
2. Temperature/humidity (enthalpy) sensors out of calibration;
3. Misunderstanding by the operators and/or controls vendors of when the economizer should and should not operate. Lack of understanding of psychrometrics;
4. Poor or no airflow monitoring. Air monitoring stations (AMS) are often installed in poor locations. They also commonly clog with dirt and lint;
5. Damper position indicators are a very poor indication of flow rate and easily get bumped or loose; and
6. VAV systems necessitate controlled and monitored movement of the OA damper to maintain minimum code required OA.

It is fair to say that a well trained and adequately staffed maintenance and controls department can

Dan Koenigshofer, P.E., is vice president for healthcare engineering at Dewberry Engineers. He is a voting member of SSPC 170, Ventilation of Health Care Facilities, and an active member of TC 9.6, Healthcare Facilities. John Roberts, P.E., is a senior mechanical engineer at Dewberry. He was previously a member of the North Carolina Energy Ad Hoc Committee.

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FIGURE 1 AHU with OA economizer.

FIGURE 2 AHU without OA economizer.

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The advantages of chiller heat-recovery, coupled with the elimination of free-cooling, are broad in both application and scope. I believe this combination would prove cost effective almost anywhere in the U.S. As Dan most wisely suggests, it's time for engineers to start running the calculations in their own climate zones to see for themselves.

David N. Schurk, Member ASHRAE,
Houston, Texas

The Author Responds

Thanks for your letter about our article. I'm glad that you agree with us.

In general, I agree that heat recovery chillers (HRC) are a good idea. We have found them difficult to actually implement because:

1. You must be able to utilize all the warm water to maximize payback of the HRC. The HW demand needs to be continuous and piped to the HRC.
2. DHW demand, even in hospitals, falls to near 0 at night so you can't cool the HRC.
3. Many hospitals do not have DHW piped to their CEP.
4. It is difficult to heat or reheat with ~120°F water, unless the coils are designed for this temperature. In practice existing coils are usually designed for 160°F to 180°F EWT.
5. As you raise the temperature of the condensing water, the HRC efficiency drops.
6. The economics are best when gas is expensive, which it is not now.

In my ALI class I praise HRCs, but note the above caveats during the design. Generally, I've found them best in new construction.

Dan Koenigshofer, P.E., Member ASHRAE,
Chapel Hill, N.C.

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