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Utilizing site-recovered energy

ERV technology helps reconcile demands for lower energy costs, better ventilation

By: Stephen Pargeter

Building owners are caught between two powerful forces: the need to lower energy costs and the need to meet or exceed outdoor air ventilation regulations for occupant health and comfort.

Large amounts of energy are wasted each day from commercial, institutional and government buildings as HVAC systems replace indoor air with fresh outdoor air multiple times per day. Heating or cooling energy is continually wasted in the exhaust air stream, while new energy must be generated and used to condition entering outdoor air.

With HVAC systems typically consuming 40 to 60 per cent of commercial building energy, owners are searching for ways to reduce these expenses. Many are turning to site-recovered energy technologies like energy recovery ventilation (ERV) that recover energy on-site and reuse it to reduce the demand for new energy.

Designed to operate with new or existing HVAC units, ERV technology provides an affordable means of reducing HVAC energy costs without compromising outdoor air ventilation requirements. In the U.S., the federal government's energy management program mandates ERV systems for federal buildings and recommends these systems be considered for schools and businesses.

Building owners seeking to maximize the profitability of their investments face several HVAC-related challenges and opportunities. These include minimizing wasted energy, replacing existing HVAC equipment and cost-effectively meeting or exceeding outdoor air ventilation requirements.

Minimizing wasted energy

A large portion of HVAC energy can be attributed to conditioning outdoor air ventilation. As fresh air is drawn into a building, stale air is expelled along with site-generated energy used to condition it. This energy-rich exhaust air represents the largest source of wasted energy in most commercial buildings. By failing to recapture this site energy, owners will continue to face rising energy costs, lower profitability and missed opportunities to reduce greenhouse gas emissions.

Existing HVAC equipment

Upgrading HVAC equipment provides an opportunity to lower building energy use. However, many energy-efficient technologies are perceived to be expensive. Fortunately, proven technologies are available to improve HVAC system efficiency and provide attractive returns. Building owners willing to apply these technologies can successfully reduce energy consumption and greenhouse gas emissions in existing buildings, often with local utility support.

Outdoor air ventilation versus energy cost

Studies have proven outdoor air ventilation creates a healthier work environment. According to the U.S. Environmental Protection Agency, indoor air can be two to five times more polluted than outdoor air, and increased amounts of outdoor air supply is generally better for indoor air quality. However, as outdoor air rates increase, so does the size, cost and operating expense of HVAC systems. Attempts to reduce these costs by lowering ventilation rates in the 1980s led to sick building syndrome and multiple indoor air quality complaints and lawsuits. Recognizing more ventilation is beneficial, building owners must find a solution to provide for the health of occupants while also controlling energy costs.

ERV technology

Energy recovery wheels, also known as enthalpy wheels, resolve the conflict between indoor air quality and energy conservation by recovering site energy contained in building exhaust air. Up to 80 per cent of this energy is recycled to precondition outdoor air, resulting in reduced HVAC load and operating cost. For new and replacement projects, energy recovery costs are typically offset by lower HVAC system first costs, while up to 80 per cent reductions in outdoor air fuel consumption provide healthy returns for the life of the HVAC system.

Energy recovery wheels may also be used to improve the efficiency of relatively new HVAC systems by up to 40 per cent, providing one to three-year paybacks when supported by a local utility.

Additionally, energy recovery wheels enable building owners interested in marketing green, healthy buildings to increase outdoor air levels above minimum building code requirements, earning LEED (Leadership in Energy and Environmental Design) points and reducing the risk of indoor air quality complaints.

How energy recovery wheels work

Enthalpy wheels transfer energy by rotating between outdoor air and exhaust airstreams to transfer heat and moisture from one airstream to the other. Certification by the Air-Conditioning, Heating and Refrigeration Institute (AHRI) verifies the effectiveness of this energy transfer. Total energy saved depends on the wheel's effectiveness and the difference in temperature and humidity between the two air streams. A bigger differential drives larger energy savings.

Energy recovery wheel benefits

Energy recovery wheels offer the following benefits:

- Sixty to 80 per cent reduction in outdoor air energy costs.
- Reduction in capital equipment cost through minimizing HVAC design loads.
- Significant increase in outdoor air levels achieved without adding load to the existing HVAC system.
- Cost-effective improvements to the HVAC system's control over indoor humidity to prevent mould and mildew.

- Maintenance of building values through maximizing outdoor air ventilation and building health, creating positive public relations opportunities.
- Less than two-year paybacks in most North American climate zones.

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