



LOCATION

On the Move
Convenience Store
Austin, TX

Challenge

As part of an overall energy efficiency improvement project, the customer wanted to significantly reduce energy consumption utilized by the existing HVAC [Heating, Ventilating, and Air Conditioning] system.

Solutions

A BPE-200 X-Type High Efficiency Energy Recovery Ventilator (ERV) with two efficient inline Fantech 150 cfm fans was installed to replace the existing ventilation system. By shutting off the existing fresh air intakes on the store’s outside air handlers and replacing them with the BPE ERV and Fantech fans, the store experienced a dramatic reduction in kilowatt (kWh) consumption. The installation occurred in August 2008. Comparing the entire store’s kWh consumption for September 2007 versus September 2008, we find the following:

September 2007
1119 daily kWh average

September 2008
898 daily kWh average

(See City of Austin Utility Services Usage History)



ANALYSIS:

Every commercial building is required by law to bring a certain amount of fresh outside air into an occupied space. (See ASHRAE Standard 62.1 and local building codes). Unfortunately, outside air is rarely the temperature or condition desired for the interior of the building.

Accordingly, most commercial buildings spend 60% - 80% of their HVAC energy consumption on tempering the outside air (variance depends on air requirements, occupancy, usage, etc.). BPE high efficiency energy recovery ventilators expel stale air from inside buildings and pull in a supply of fresh outdoor air. In the process, an extremely efficient transfer of energy takes place between the two air streams inside the units. This allows stale air to be exhausted from a building while supplying occupants with fresh air that is typically pre-tempered to within 5-degrees of room temperature. This occurs without cross contamination of fresh and stale airflows. The overwhelming majority of convenience stores comply with ASHRAE standard 62.1 and local building codes via outside air intakes on their buildings' air handlers (usually located behind, on the side, or on the roof of the store). This is inefficient and undesirable for two reasons: 1) There is no pre-tempering of the outside air which causes the HVAC system to work much harder and the outside air is merely diluted with the inside air. 2) The outside air intakes are often located near the ground where there is a high degree of air contaminants such as dust, dirt, allergens, mold, and odors. These contaminants get pulled in by the air handlers and can increase HVAC maintenance problems, lowering indoor air quality. By shutting off the HVAC system's outside air intakes and installing a highly efficient BPE X-Type Energy Recovery Ventilator running at 80% or higher thermal efficiency with two efficient inline fans, we can accomplish the following: 1) Dramatically reduce HVAC energy consumption by 35% or more. 2) Create an opportunity to place the air intake for the BPE unit higher off the ground. This allows better quality air into the store while avoiding undesirable ground-level contaminants. 3) Swap out dilution ventilation for *displacement* ventilation, which is a more thorough manner of exhausting stale indoor air as pre-tempered fresh outdoor air is pulled inside.

DEMAND SIDE VENTILATION WITH CO2 SENSORS:

Recently, BPE, Inc. and Fresh Air Energy have collaborated with a nationally recognized industrial hygienist, Steven Olivetti of SK Environmental Associates, LLC, to develop an installation method that significantly reduces HVAC energy consumption above and beyond that which is already achievable as discussed above (see SK Environmental Associates Study Regarding Hopewell Valley Regional School District). This simple, effective method involves the installation of CO2 sensors connected to the fans. Accordingly, when the CO2 level inside the occupied space reaches a preset condition, the fans turn on automatically. When the CO2 level decreases to a pre-set condition, the fans turn off automatically. Thus, the ventilation system operates only when necessary. In contrast, the ventilation systems of most convenience stores (and many commercial buildings) operate around the clock taking in outside air whenever

the air conditioning or heater is running. Depending upon occupancy conditions at a given convenience store, this method should reduce outside air intake by two-thirds or more. As with school classrooms, this installation method (demand side ventilation with CO₂ sensors) is particularly appropriate for convenience stores. This is because of the high degree of occupancy variance that occurs during store hours. There is little to no need for outside air ventilation when there are no customers. There is, however, a need for outside air ventilation under more crowded conditions.

CONCLUSION:

Using demand side ventilation with CO₂ sensors coupled to a highly efficient BPE X-Type Energy Recovery Ventilator and two efficient inline fans accomplishes the following: 1) The ventilation system operates only when necessary. 2) When the ventilation system does operate, it will operate through a reliable ERV operating at 80% or greater thermal efficiency. 3) Indoor air quality is improved using displacement ventilation and a fresh air intake placed in a desirable location. 4) HVAC energy consumption should be reduced by 65% or more.