



Building Performance Equipment, Inc.™

Scientists and Engineers



LOCATION

**On The Move
Convenience Store
Austin, Texas**

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.

SOLUTION

A BPE-200 X-Type High Efficiency Energy Recovery Ventilator was installed with two inline efficient Fantech 150cfm fans 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 Energy Recovery Ventilator and Fantech fans, the store experienced a dramatic reduction in kilowatt consumption. The installation occurred in August, 2008. Comparing the entire store's KWH consumption for September, 2007 versus September, 2008, the following is shown:

September, 2007
2604.01 total KWH
1119 daily KWH average

September, 2008
2115.85 total KWH
898 daily KWH average

(See City of Austin Utility Services Usage History)

Additionally, indoor air quality was significantly improved.



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ANALYSIS:

Every commercial building is required by law to bring in a certain amount of fresh outside air into the occupied space. See ASHRAE Standard 62.1 and local building codes. The problem is that the 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.). The BPE high efficiency energy recovery ventilators remove stale air from inside a building and supply fresh outdoor air to the building. 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 the building while supplying it with fresh air that is pre-tempered usually to within 5-degrees of room temperature with no cross contamination of fresh and stale air.

The overwhelming majority of convenience stores comply with outside air requirements of ASHRAE and local building codes through the utilization of 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; and
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 increasing HVAC maintenance problems and 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 above thermal efficiency with two efficient inline fans, we can accomplish the following:

1. **Dramatically reduce HVAC energy consumption usually on the order of 35% or more;**
2. By placing the air intake for the BPE unit in a desirable location high off the ground, better quality air can be introduced to the store while avoiding the undesirable contaminants; and
3. By using displacement ventilation instead of dilution ventilation, a more comfortable and enjoyable indoor air quality can be achieved by exhausting stale indoor air and supplying pre-tempered fresh outdoor air.



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DEMAND SIDE VENTILATION WITH CO2 SENSORS:

Recently, BPE and FreshAir 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 automatically operates only when necessary. In contrast, most convenience stores' (as well as many commercial buildings) ventilation systems 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.

Like 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 during 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, we can accomplish the following:

1. The ventilation system operates only when necessary;
2. When the ventilation system does operate, it will operate through a reliable energy recovery ventilator operating at 80% or above thermal efficiency;
3. Indoor air quality is improved through the use of displacement ventilation and a fresh air intake placed in a desirable location; and
4. **HVAC energy consumption should be reduced by 65% or more.**



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