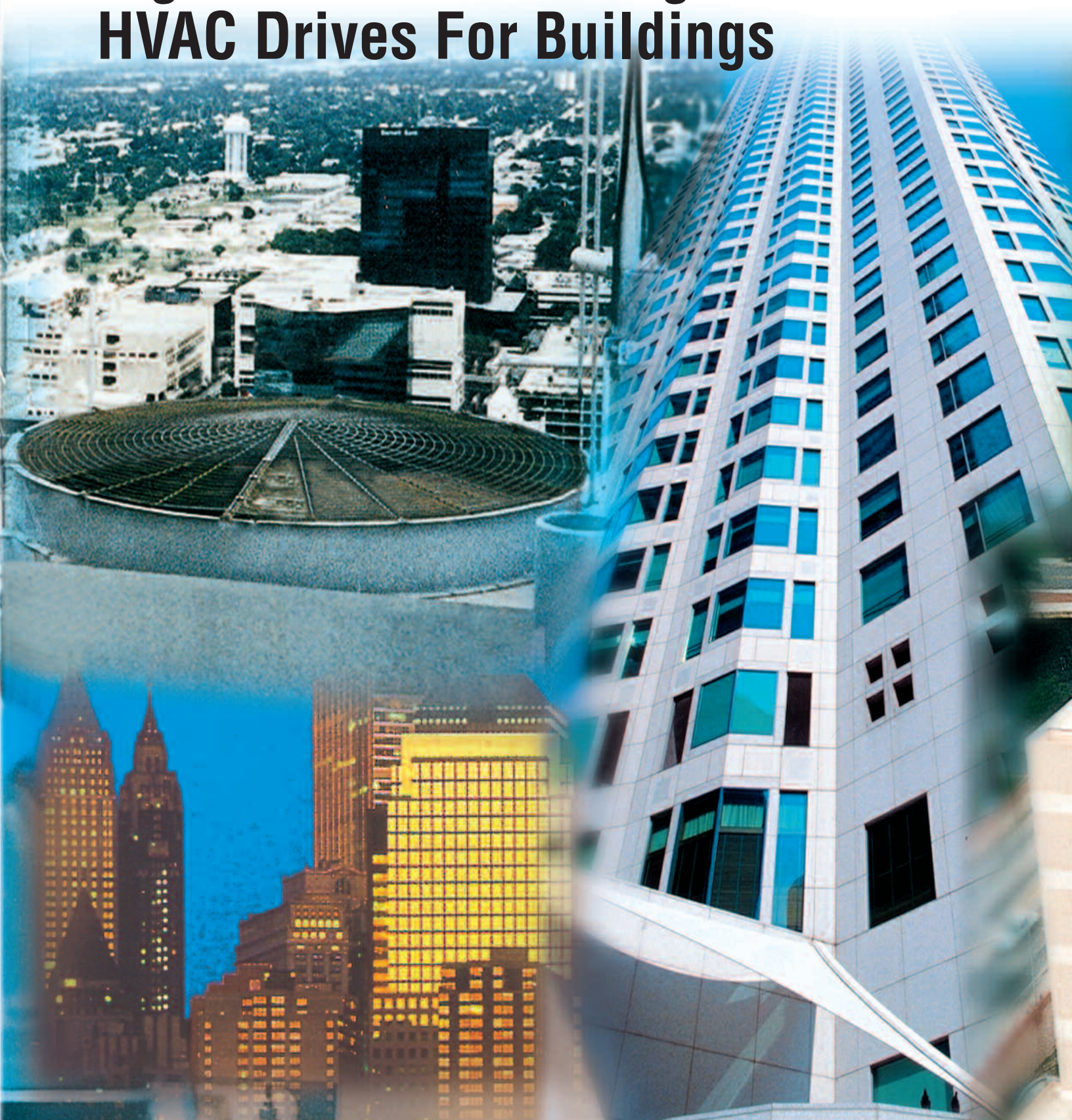
YASKAWA

Significant Cost Savings
HVAC Drives For Buildings



The Big Impact of Energy Cost

Energy usage in a typical office building costs the owner between $1 and $3 per square foot. The air handling systems account for around 28% and the cooling systems for about 24% of the electricity consumed. That's roughly half of your electric bill. You have the means of reducing air handling and cooling energy costs by 20%.

For a 100,000 sq. ft. building, total savings can range from $10,000 to $30,000 every year.

The key to savings on this scale is the judicious use of variable frequency drives.

Variable Frequency Drives Reduce Energy Use

Variable frequency drives are reliable electronic devices that control electric motor speed. They are used in commercial and industrial buildings to control the speed of fans and pumps in HVAC systems. Variable frequency drives consume less energy than mechanical flow control systems.

The payback period for installing drives is usually less than three years and can be less than a year. Some utilities also offer rebates for installing HVAC drives in new or retrofit work.

Other Benefits in Performance and Savings

Drives do more than reduce energy cost:

- Drives reduce fan noise and duct rumble, thus reducing tenant complaints.
- Drives reduce amps during motor starting, lowering demand charges; another part of the electric bill.
- Drives are less expensive to maintain than mechanical controls.
- Inherent soft starting reduces wear and tear on motors and other system components.
- Drives provide accurate and repeatable control of HVAC settings, eliminating frequent readjustments.

Upgrading with variable frequency drives is one part of the Environmental Protection Agency's effort to improve energy efficiency. In addition to making good business sense, installing drives demonstrates corporate environmental consciousness.

Other Kinds of Buildings That Can Benefit

Although many of the examples in this brochure refer to office buildings, other facilities offer ideal opportunities for energy savings:

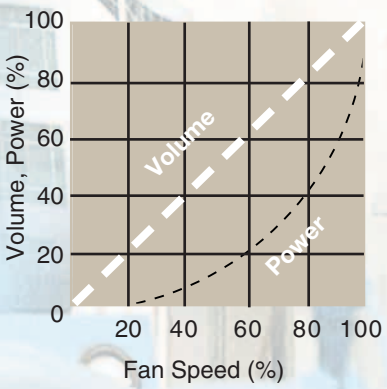
- institutional facilities
- educational facilities
- medical facilities
- parking structures
- industrial assembly plants

Yaskawa has been providing energy efficient drives for fans and pumps since 1970. A Yaskawa representative can help you identify where drives will have the biggest payback.

Drives Save Money: It's Pure Physics

Why Drives Save Energy

The physical laws that govern centrifugal fans and pumps dictate that the volume of air or water decreases directly with fan or pump speed. Power consumption, on the other hand, decreases with the cube of speed. *So a small reduction in speed produces a significant reduction in power consumption.*



Since a variable air volume HVAC system usually operates at less than full volume, adjusting fan and pump speeds as the method of adjusting volume requires considerably less energy than methods where motors run continuously at full speed.

Comparison of Variable Air Volume (VAV) Control Options

Outlet dampers are metal blades positioned in the air stream on the outlet side of the fan. The fan operates at constant speed. Air volume is reduced by closing the damper restricting airflow.

Inlet guide vanes are mounted in the fan inlet. Volume is reduced by altering the vane position to pre-rotate the air going into the fan causing reduced flow capacity. Fan speed remains constant.

Variable frequency drives reduce air volume by lowering fan speed.

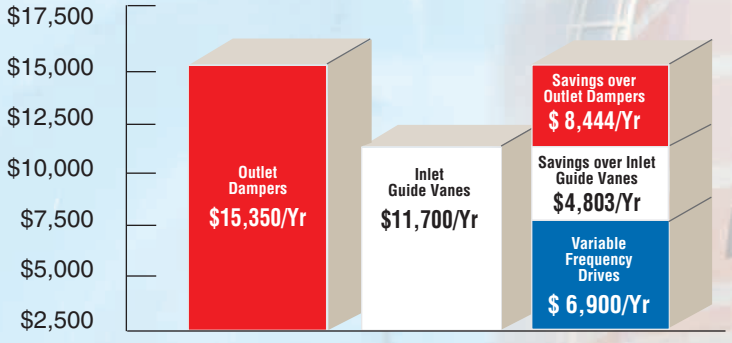
Savings Example

To compare VAV control methods and their savings, let's look at the example of a 100,000 sq. ft. building with an HVAC system operating 3600 hours/year (roughly 10 hours/day) and two 30 horsepower motors operating supply fans in two air handling units.

- At peak load, each fan is operating at top speed at 100% volume and the power consumption of all three control methods would also be 100%.
- When the HVAC load drops to 80% volume, the fans operating with outlet dampers and inlet guide vanes would still be running at top speed and drawing 94% and 72% input power respectively. In contrast, the fans controlled by a drive are running at a reduced speed and only 51% input power.
- When the load reduces further to 60% volume, fans controlled with outlet dampers and inlet guide vanes consume power at 88% and 62% respectively. Input power for the adjustable speed fan is only 28%.

The annual power savings of using variable frequency drives in this building are 93,823 KWHr or $8444 compared to outlet dampers and 53,367 KWHr or $4803 compared to inlet guide vanes. (Rates at $.09/KWHr)

Typical Energy Cost Comparison



Qty (2) 30HP Fans Running 3600 Hours Per Year

How to Get Started Fast

Help in Finding the Opportunities in Your Building

Your first step is to conduct a building survey to determine the types of systems you have and to gather the data that will be needed in your savings calculations. Your Yaskawa representative can supply survey forms or, if you prefer, will be glad to walk the building with you and record the information needed.

A Quick & Easy Way to Estimate Your Savings

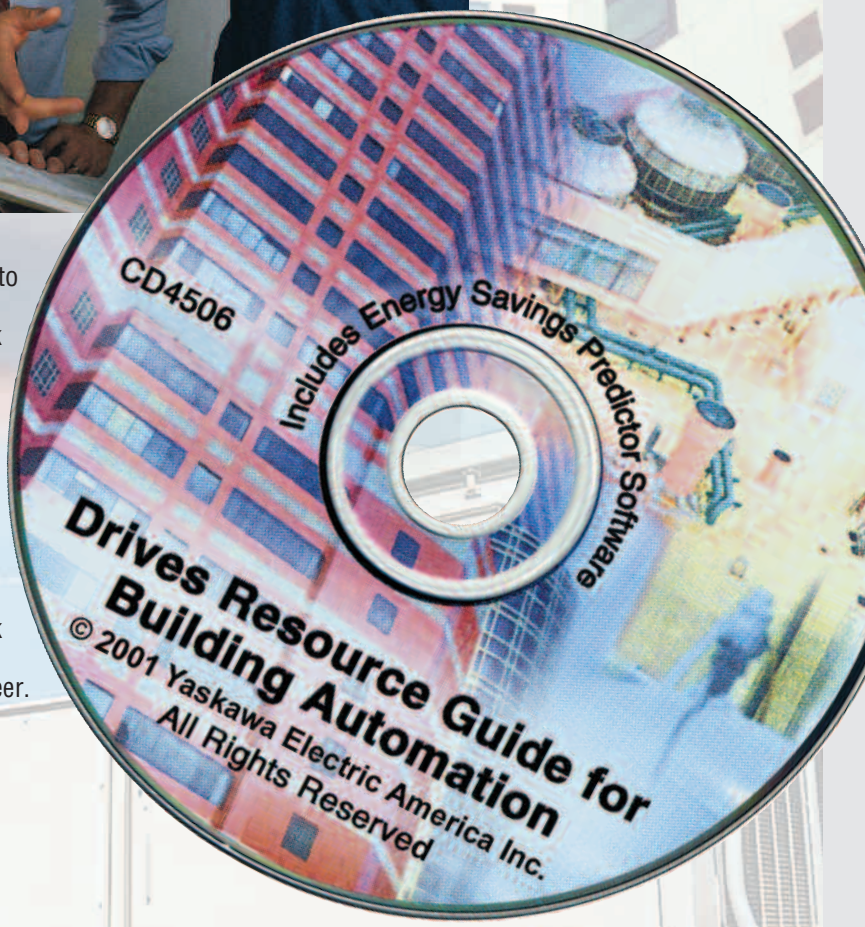
Pump and fan savings can be figured by determining system curves, establishing the average duty cycle, the motor size, the motor efficiency and the cost of electricity. By applying these numbers to a formula for operating costs for each type of flow regulation method, payback periods can be calculated.

A much simpler method is to use Yaskawa's Energy Savings Predictor (ESP) computer program. It will do the calculations for you and already contains electricity costs for your area.

More Help & Information Available

Your Yaskawa representative can supply you with more detailed information on the application of drives and motors to HVAC systems as well as performance and specification data on recommended Yaskawa drive models and energy efficient motors.

Contact Yaskawa to get started on the fast payback track to energy and maintenance savings. If you don't know the name of your nearby representative, call Yaskawa toll free at 1-800-927-5292 and ask for an HVAC application engineer.



Put Drives on Your HVAC System Where It Pays

Fans

Supply fans in variable air volume (VAV) systems offer exceptional savings opportunities. Exhaust and return fans are also good candidates for drives. These fans are sized to meet the maximum flow rate required by the system. From an air conditioning standpoint, this would be the hottest day outside combined with the largest cooling load required inside the building. Obviously, the amount of time a fan needs to operate at those peak loads is infrequent. To adjust the air flow without drives, mechanical devices control the air flow into the fan (inlet guide vanes) or leaving the fan (outlet dampers). You can replace either mechanism with a drive and control the flow by directly reducing fan speed. Energy cost is reduced because drives use less energy than the mechanical systems.

Pumps

The control schemes for centrifugal pumps in secondary distribution systems share the same basic energy concerns as fans. These pumps are also sized for maximum flow rates. Mechanical devices (valves for throttling or bypassing) are used to adjust flow. By using a drive to directly adjust the pump speed (and, therefore, flow), energy savings can be substantial. In addition, the “soft” starting by a drive lessens water hammer and in-rush current.

Cooling Towers

Cooling towers offer several opportunities for cost reduction. Use of a drive to control cooling tower fan speed requires less power than cycling a two-speed motor. Energy savings is achieved through elimination of excess air flow. Better control of the return water temperature increases chiller efficiency, one of the largest power consumers in the facility. Precise control also reduces the amount of make-up water required. Overall, a drive is less stressful on the system, extending the life of gears, belts, bearings and drive motors.

Why Yaskawa?

- **For a cost effective startup.** Three wires in and three wires out, plus the serial communication connection is normally all it takes to install.
- **For simple retrofit schemes** for existing buildings . . . install the drives, lock out the previous system and you're back in business
- **For multiple control configurations** to meet your application needs: 3 contactor bypass, multi-motor "and" operation, multi-motor "or" operation, soft-start bypass; packaged in either NEMA 1, 12 or Type 3R enclosures.
- **For power quality solutions** such as a DC bus reactor (standard above 25 HP), input reactor, 12-pulse transformer, motor protection filters, and trap filter options.
- **For drive solutions** ranging up to 1500 HP at 460 VAC, 200 HP at 600 VAC, and 125 HP at 208/230 VAC.
- **For the best drive MTBF in the industry.** Yaskawa drives have a statistical reliability of 28 years continuous operation between failures. This high reliability is confirmed by a return/repair rate of less than 0.005%.

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