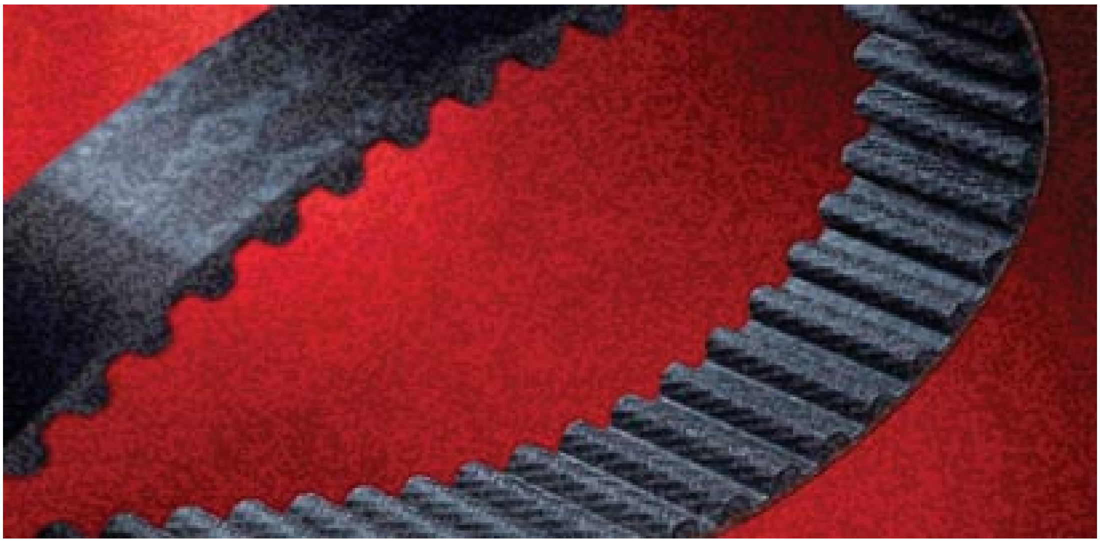

While they may not be right for every application, use of these belts might help you cut your electrical bill.

As much as 70% of the total electrical energy that an industrial facility consumes can be attributed to electrical motor drive systems. With ever-increasing energy costs, no wonder plant engineers are constantly looking for ways to increase the efficiency of their motors and motor-driven systems. The most common solution is to replace old motors with new, energy-efficient units. Another simple and cost-effective solution is to convert V-belt drives to synchronous drives.
Efficiency of a drive relates to its ability to transmit useable energy from the driver to the driven equipment. Higher efficiency means less energy loss. As with most other systems, the primary form of energy loss in belt drives is heat generated by friction.

Justifying a switch
As a belt drive operates, the belt is put though a constant cycle of flexing and relaxing as it passes around the pulleys and through the straight sections. When this occurs, internal friction produces heat. Standard V-belts—*because of their design and geometry*—have the greatest resistance to bending and, thus, produce the greatest amount of heat. Cogged or notched V-belts have less resistance to bending and produce less heat. In fact, just switching from a standard V-belt to a cogged V-belt increases efficiency by about 2%. Synchronous belts, by nature of their teeth, are also cogged and feature a flatter design, which produces even less heat.

Synchronous belts operate consistently at an average of 98% efficiency, making them, on average, 5% more efficient than V-belts. V-belt drives rely entirely on friction between the belts and sheave grooves to transmit power. Adequate friction is obtained through proper tensioning of the belt. Standard V-belt drives, though, can stretch up to 3% of the original length throughout the life of the belt. If proper tension is not maintained, the required friction can be lost and the belt can slip. When slip occurs, additional heat is generated between the belts and grooves. Slippage can also occur during torque spikes, such as at startup. Synchronous drives feature a positive drive design; they have teeth to transmit the required torque. Since they do not rely entirely on friction to transmit torque, less heat is produced. Furthermore, because they have teeth, synchronous belts do not slip.

Since efficiency loss equates to heat generation in belt drives, one would expect to see a difference in operating temperature between V-belts, cogged V-belts and synchronous belts. This rationale holds true as V-belts generally run
40-80 F degrees above the ambient temperature, cogged belts approximately 30-50 F degrees above ambient and synchronous belts only about 20 F degrees above.

At the time of proper installation, V-belts can run between 95% and 98% efficiency. The efficiency then falls to an average of approximately 93% during normal operation. Without proper maintenance, actual V-drive efficiencies can fall even lower. Conversely, synchronous belts operate consistently at an average of 98% efficiency—*making them, on average, 5% more efficient than V-belts*.

Let's look at an example of the savings that can be achieved by converting a V-belt-driven fan application to a synchronous belt drive.

Application Data	Motor	10HP, 1800RPM
Load Factor	0.8	
Driven	Fan @ 1500RPM	
Operating Hours per Year	7200	
Electricity Cost	$0.0965/KWH (U.S. National Average)	
Current Drive	V-Belt	
Est. V-Drive Efficiency	93%	
Est. Synchronous Drive Efficiency	98%	

Yearly Savings = $0.746 \times \text{hp} \times \text{Load Factor} \times {}^{\text{hours}}\!/_{\text{year}} \times ({}^{100}\!/\text{eff}_{\text{v-belt}} - {}^{100}\!/\text{eff}_{\text{sync}}) \times {}^{\text{Cost}}\!/_{\text{kwh}}$

Yearly Savings = $0.746 \times 10 \times 0.8 \times 7200 \times (^{100}/_{93} - ^{100}/_{98}) \times \$0.0965$

Yearly Savings = $227.48

The savings reflected in our example may not seem significant, but the payback is often not much more than one year.

Additional considerations
While synchronous drives do offer energy savings over V-belt drives, all aspects of the drive should be considered before making the decision to switch. Each type offers its own benefits and drawbacks. Listed below are some of the common considerations.

- While synchronous drives do offer energy savings over V-belt drives, all aspects of the drive should be considered before making the decision to switch. OEMs often design V-belt drives for a certain amount of slip as a means of handling torque spikes and isolating valuable equipment. Should a torque spike occur and the torque capacity of the belts be exceeded, say at startup, a V-belt would slip, preventing the torque spike from being transferred to other attached equipment. In the same situation, a synchronous belt may simply fail, or worse, transmit the torque and damage to other, more expensive equipment.

- Synchronous belts are generally noisier than V-belts, particularly at high speeds, and can sometimes require soundproofing belt guards.
- V-belts generally last longer than synchronous belts.
- Synchronous belts often operate at a much lower static tension, which can lead to greatly increased service life of bearings.
- Synchronous belts also require less maintenance than V-belts.

Synchronous belts are not the right choice for every application, but they do offer a low-cost option for achieving real energy savings. **MT**

William Tarr is a customer order engineer with Baldor's Dodge Bearings & Mechanical PT Components business. Telephone: (864) 281-2253.