by JOHN GUTHRIE
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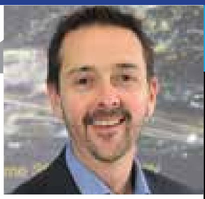

Energy assessment
unlocks savings potential

The right combination of variable-speed drive and motor can cut the electricity bill for a pump or fan by up to 60 percent. In just half a day, an energy assessment can give a good estimate of how much energy can actually be saved. ABB's John Guthrie explains.

Electric motors are crucial to many commercial buildings and industrial processes. Often, there are hundreds of them in just one building or plant. On average these motors account for 65 percent of any facility's total electricity consumption, but several measures can be taken to reduce that figure and the total cost of ownership.

> "AN ENERGY ASSESSMENT INCLUDES THE WHOLE CHAIN, FROM DATA COLLECTION TO FOLLOW-UP OF THE RETURN ON INVESTMENT AND YET AN EFFECTIVE ASSESSMENT CAN BE MADE IN JUST HALF-A-DAY, USING A WELL-DEFINED PROCESS THAT USES SPECIALLY DEVELOPED SOFTWARE."

Motor control methods

By far the most effective method of controlling a motor's speed is through the use of electronic variable-speed drives (VSDs). However, in many instances control is still performed with throttling valves in pump systems or vanes in fan applications, while the demands for rotating machinery are solved by gears or belt drives. Speed control with belt drives, gearboxes and hydraulic couplings all add to the inefficiency of the system and often requires that the motor runs at full speed all of the time.

In addition, mechanical drives can be noisy as well as difficult to service, situated as they are between the motor and the driven machinery. These arrangements often seem cost effective at first but they are energy wasting.

Energy assessment

One way to lower energy costs is to undertake an energy assessment or appraisal of your installed motor-driven applications, which focuses on variable torque applications, such as centrifugal fans, pumps and compressors. These are applications where the flow of air or fluid has been traditionally regulated with some kind of mechanical device, which results in unnecessary losses.

An energy assessment includes the whole chain, from data collection to follow-up of the return on investment and yet an effective assessment can be made in just half a day, using a well-defined process that uses specially developed software.

Simplifying your world without limiting your possibilities.

The ABB industrial drive, ACS880, simplifies your world because it is all-compatible. It is designed to tackle any motor-driven application, in any industry, whatever the power range. The drive can be flexibly connected to different automation networks, and through the use of direct torque control, it precisely controls different motors such as AC induction and permanent magnet. Yet, despite the drive's wide-ranging capability, it is remarkably easy to use and integrate.

To learn about ABB industrial drives and the benefits they can offer to you, visit
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Energy assessment for motor-driven applications

1. Get a picture of the facility and its applications, including a motor inventory and anything unusual that could affect the assessment

2. Spot applications that are typically running inefficiently. Check the rating plates on the motors or monitor them to get their actual electricity consumption.

3. Enter all data into the dedicated software and make an analysis based on the results. They include present energy usage, potential savings, pay-back time, CO_2 reduction and other key parameters.

4. Prepare an action plan including an executive summary and a detailed engineer's report.

5. Identify the optimum drives and motors based on the results from the analysis.

6. Track the actual savings against the forecast in the engineer's report. Monitor the electricity consumption for the applications involved and compare with the specification to spot any deviations.

Variable-speed drive

Using a VSD to adapt the speed of an electric motor connected to a fan or pump to obtain the required flow can reduce electricity consumption by up to 60 percent. This is because the electric power required is proportional to the cube of the speed. If the speed drops to 80 percent of its full value, the power demand drops to 51 percent (0.83).

So, following this theory, if you fit a VSD, then slowing down the centrifugal pump or fan by just 20 percent will save you almost 50 percent power. As many fan and pump systems run at less than full capacity most of the time, a VSD can make huge savings. This is particularly so when compared to a motor that is continuously running at full speed.

However, it is important to take into account design oversizing, throttling, head and VSD losses, otherwise the existing energy usage and the potential savings will be over-stated.

Take this table as an example:

Fixed speed cost	£22,308
Speed reduction	20%
Monthly energy saving	£907.19
Annual energy saving	**£10,886**

From a 20 percent speed reduction and using the full 48.8 percent from the cube law - 0.8^3 = 0.512 – results in a saving of £10,886 saving. But the figures fail to take into account the characteristics of even a generic pump system as well as the losses in the drive. Doing so would at least come up with a conservative energy saving figure of around 35–40 percent, resulting in an annual energy saving of around £6,700.

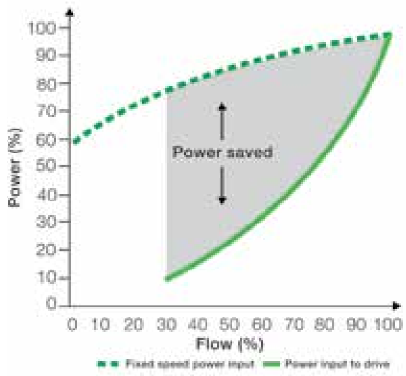
The power is no longer shown as a curve but as a constant at 100 percent across the top. Remember the graph on the right represents the usage in a throttled system. The graph on the left shows the over-exaggerated savings. The more realistic curve is that in the far right.

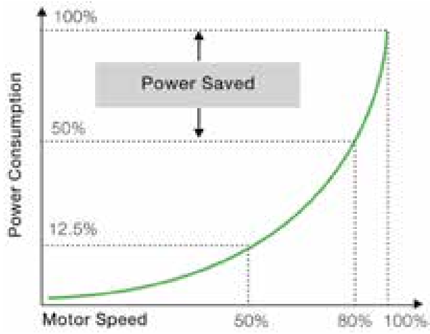
The proof will come in reality, where, say, swimming pool pumps are turned down by 20 percent but only manage a 38 percent power saving and NOT the predicted 50 percent using the above approach. Yet, using our realistic approach, the savings are exactly within the range of our prediction.

The result is that some within the industry are claiming the motor costs you much more to run than it actually does and hence greater potential savings.

Let's make no mistake; the savings offered by VSDs are outstanding. There are thousands of examples throughout industry that show compelling energy saving reasons to install VSDs. However, it is important to ensure that real-world figures are being used otherwise the theoretical claims will not stack up in reality.

Regulating the motor speed has the added benefit of easily accommodating production rises without extra investment, as speed increases of 5–20 percent are possible with a VSD. By matching the performance of the motor to the needs of the process, VSDs can give major savings, compared to the wasteful practice of running the motor at full speed against a restriction to modulate output.





Top-five motor applications with energy savings potential

These are applications where the existing motor is running at fixed speed, directly off the mains supply:

1. Variable torque applications, such as centrifugal pumps and fans, operating with partial flow, controlled by a damper or throttle value: Energy saving typically up to 70 percent.

2. Same as above but with no flow control, where lower constant speed and partial flow is enough, due to oversizing of the pumps/ fans and motors: Energy saving typically up to 30 to 50 percent.

3. Other standard motor driven applications, such as screw compressors and mixers. Energy saving typically up to 20 percent.

4. Continuously running old motors which are oversized: Energy saving typically up to 8 percent.

5. Continuously running old motors, not oversized but inefficient, due to age, damage or multiple rewinds: Energy saving typically up to 5 percent

Over-dimensioning

Nowadays, old, over-dimensioned electric motors are increasingly being replaced by modern energy-efficient ones. This follows legislation that is being introduced in many countries, setting minimum efficiency performance standards (MEPS) for electric motors.

Users can also do a great deal to ensure they are getting the highest efficiency from their motors. A defined motor management policy needs to be in place. One policy decision should be to select high efficiency motors when purchasing new plant. Users need to specify minimum acceptable efficiency values.

A motor management policy helps bring together capital, maintenance and revenue budgets, showing the effect they have on each other when different types of motors are selected.

Users benefit from such a policy through reduced energy costs, by upgrading to high efficiency motors at the most cost-effective time. The forward planning inherent in the practice helps reduce downtime and inventory can also be reduced through a fast track delivery agreement.