

SYNRM MOTORS AND VARIABLE SPEED DRIVES: IMPROVING ENERGY EFFICIENCY IN THE WATER INDUSTRY

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Timo Kaarna, ABB Motion's segment manager for water and wastewater in the low voltage motors division, discusses the role that motor and drive technology can play in making water and wastewater industry operations more efficient. This saves operators money and contributes to the global journey to Net Zero.

Moving and processing the incredible volumes of water required by modern society is extremely energy intensive. Research by the International Energy Agency (IEA) suggests that as much as 4% of the world's total electrical energy is used by the water and wastewater segments. Considering this amount of energy, even marginal efficiency gains would represent huge savings in absolute

terms. Fortunately, experts estimate that energy consumption by the sector could be cut by as much as 15% by 2040 if energy efficiency and recovery measures are adopted worldwide.

This is a significant opportunity from both a financial and environmental point of view. Today, electricity makes up an average of 45% of a water processing facility's operating cost. Any gains in

efficiency will directly reduce this operational expenditure. At the same time, cutting total energy use brings us closer to Net Zero and reduces the emissions associated with this vital industry.

Where can energy be saved?

A significant portion of the electricity used in the water and wastewater industries goes toward powering pumps. These pumps are driven by electric motors, so upgrading to more efficient motors is an effective way to save power.

Internationally, motor efficiency is categorized by the IEC efficiency rating system. Each increase in category, such

as from IE3 to IE4, represents a 20% decrease in energy losses, meaning that the motor is more efficient. In Europe, China, and several other countries, new installations are required to use IE3 motors or better – but many older installations often still rely on IE1 and IE2 motors.

Today, the most efficient motors, including the synchronous reluctance motors (SynRM) from ABB, have an IE5 “ultra-premium” rating. If a facility upgraded from the minimum specified IE3 motors to IE5 SynRM motors, energy losses would be reduced by approximately 40%, cutting energy bills significantly.

Even greater efficiency is possible when an operator pairs a motor with a variable

speed drive (VSD). A drive controls an electric motor to match its speed and torque to those required by the application. When a motor is not controlled by a drive, it typically runs at full speed regardless of the load requirements. To control the water flow, operators apply throttling downstream – similar to using a car's brakes while keeping the other foot on the accelerator. This means that the motor consumes the same amount of power regardless of output water flow, which wastes electricity.

By comparison, a drive can adjust the motor's speed directly. Any time the motor is not running at full speed, it is consuming less energy. As a result, significant energy savings are possible. For example, with a pump or a fan, because the relationship between motor speed and energy consumption is non-linear, using a drive to reduce the motor's speed by just 20% cuts energy use by 50%.

Rapid deployment, rapid ROI

The exact savings from a drive-motor package depend on the application and use conditions but switching to an IE5 SynRM and drive package typically reduces energy bills by as much as 30%. In addition to potential power savings, ABB also produces drives specifically for water industry applications, such as the ACQ580, which have additional useful capabilities. These features include sensorless flow calculation, multipump control, level control, soft pipe fill, dry run protection, quick ramps and pump cleaning.

ABB drives, including the ACQ580, deliver reliable performance and low maintenance costs. Their simple form factor and plug-and-play features mean that they can easily be added to existing installations, new projects and OEM designs.

Upgrading to an IE5 SynRM-drive package is also simple to justify from a financial perspective, as the upgrade will quickly pay for itself in energy savings. The expense of purchasing a motor is just a tiny fraction of its lifetime cost, and the main operating expense is energy. While an IE5 SynRM-drive package may cost slightly more up front, reduced energy savings will often pay for the difference in as little as a year. Beyond that, the motor will continue to yield savings for its entire ten-plus-year lifespan.

To better understand the real-world potential of these technologies, we can look at the example of the Bocholt sewage treatment plant in Germany, which upgraded its second sludge pumping station from six older motors to four ABB SynRM motor-drive packages. The drives selected automatically adjust the motor's speed according to hydraulic load, saving additional power. As a result of the changes, the facility has cut its energy consumption by 40%.

Improving efficiency – it just makes sense

Adopting more efficient motors and drive systems in the water and wastewater sector is a clear value proposition. Not only do these upgrades enable operators to simultaneously cut costs and do their part for the planet, but they also pay for themselves in savings over a remarkably short period of time.

For more information, please [click here](#)

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