Full throttle

Is the plastics industry motoring towards sustainability? **Fausto Belotti** finds out

Reducing plastics' impact on the environment is a major focus of the global conversation about sustainability. To address concerns, the industry is embracing recycled plastics and bioplastics – biodegradable materials produced from renewable resources such as vegetable fats and oils. However, facilities need the right machinery to produce these materials effectively. The single- and twin-screw extruders being installed and upgraded today must deliver high levels of performance, reliability, and energy efficiency.

Delivering consistent output from a screw extruder depends on maintaining a stable internal pressure. This is particularly important for recycled plastics and bioplastics, which can be more challenging to use than traditional plastics. Recycled plastics can be more variable in quality than virgin material and contain moisture and/or contamination. Bioplastics tend to be more sensitive to heat variations. Maintaining internal pressure, in turn, depends on precise control of the motor turning the screw.

Modern variable-speed drives give operators a high degree of motor control. They work by changing the supply of electricity to the extruder's motor to adjust its speed and torque. Today's alternating current (AC) drives can control the pressure within a screw to within 0.01 bar in closed and open loop configurations. They are also easy to adjust to compensate for differences in plastics properties or the characteristics of an individual machine.

Choosing the right type of motor is also essential. Several types are commonly used in screw extrusion. Low-inertia motors are popular for their size and power density. Additionally, the common form factor of AC and direct current low-inertia motors makes it easy for facilities to switch and replace them. High dynamic performance induction motors create new opportunities for machine-building OEMs seeking motor and drive solutions with dynamic response and high power density.

Motors incorporating a cooling water jacket are a good option for those applications needing a higher power density. Despite the higher power density, water jacket cooled motors produce less noise as they do not require cooling fans and the jacket reduces the transmission of sound. For maximum efficiency, facilities should choose the latest synchronous reluctance motors (SynRMs). These use a different technology than induction motors and, as a result, operate quietly and produce very little waste heat.

SynRMs are also highly reliable, reducing the amount of maintenance required. For screw extrusion applications, they are preferable because of their ability to deliver high torque from zero speed during start-up and they run an encoderless open loop control, which enables a high level of precision.

Maximising energy efficiency with motors and drives

Another dimension to plastics' sustainability is the energy used in production. Facilities are looking for ways to reduce both their energy usage and carbon emissions. Operators are also seeking ways to cut energy use, as electricity – especially that consumed by motors – is typically one of their greatest operational expenses. Installing more energy-efficient motors is one of the best ways to cut total energy use.

Variable-speed drives can significantly reduce the amount of energy used by motors, as they run exactly as fast as required to deliver a given output. A drive's energy savings are particularly significant because of the relationship between motor speed and energy use. Adding a drive to a motor can save 25 per cent energy or more.

In the case of PrimePac's plastics manufacturing facility in Northern Ireland, this energy efficiency enabled machinery to be added while operating on a single power supply. The company's old hydraulic motor was inefficient and there wasn't enough power from the 600 kilo-volt-ampere electrical supply to run additional machines. By switching to SynRMs controlled by industrial drives, the machine's energy consumption dropped by 60 per cent. The upgrade paid for itself through savings on electricity in just one year.

Creating a smarter facility through digitalisation

Digitalisation in plastics manufacturing is also key to operating sustainably. By collecting and processing data remotely through a condition-monitoring platform, facilities can improve asset utilisation and reduce waste. Accurate data insights and service expertise enable operators to identify human error and issues with machines before their effects can be felt, avoiding damage to productivity.

Modern digital solutions provide customers with access to a monitoring portal to view key operational parameters of individual assets as one unified system. Customers can take actions that lead to less downtime, extended equipment lifetime, lower costs, safer operations and increased profitability.

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This technology can also help with improving energy efficiency by deploying a digital energy appraisal. Data collected from the powertrain is automatically processed to provide data-driven insights that can be used to reduce the power consumption of the company's powertrains. Because the data is available in real-time, the customer benefits from instant insights into the energy use of their fleet, as well as accurate assessments of the energy-saving potential of individually connected assets because the data is gathered over longer periods of time. It can also be used to reveal hidden opportunities to improve energy efficiency.

In essence, modern motors and drives enable facilities to cut energy use for typical machinery like extruders, which is good news for both operators and the environment.