Pneumatic innovations for reduced carbon footprint

Brian Abbott, product manager for SMC Pneumatics South Africa, takes us on a tour of some of his company's energy-efficient product displays at its Midrand showroom.

Protecting the environment, carbon footprint reduction and saving energy are global trends that have been driving the development of new SMC products for several years. "Reducing consumption of air and energy, along with the associated costs, contribute towards competitiveness and sustainability for modern producers that depend on pneumatics," says Abbott, adding that SMC supports these initiatives through small and big innovations and product enhancements.

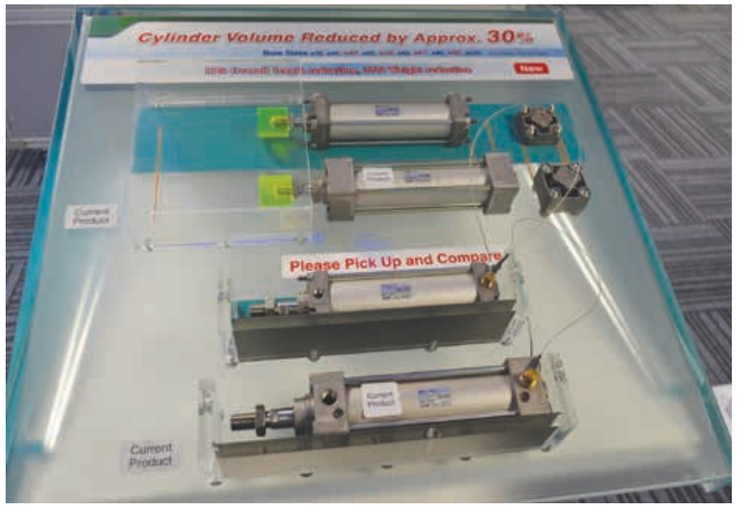
Globally, SMC's energy-savings campaign includes energy-saving products; leak detection systems; savings assessment tools and audit services: "And local expertise is on hand to help clients to benefit from any of these initiatives," says Abbott.

At the simplest end of the spectrum, Abbott takes us to a display of standard actuators. "But these are not so standard," he notes. "With the carbon footprint of our products in mind, we have redesigned SMC's standard pneumatic cylinders to make them smaller, lighter and made from less material – this without changing the pressures or strokes or removing any of their functionality.

SMC´s optimised J Cylinders offer weight and volume reductions. The cylinders themselves are 11% shorter in length, although the net stroke is unchanged; weigh 27% less and have 30% less volume than their CM2 series equivalents.

Through lightweighting and design optimisation of components such as shafts, pistons, end-caps and cylinder barrels, the same amount of force can be generated from a lighter actuator with a much smaller physical size and carbon footprint. "For mobile equipment, for example, as well as the material saving, less weight has to be moved so less energy is required to move it. Cylinder installation space is reduced by a third. This all adds up to significantly improved operational efficiencies; more cost-efficient machines, improved cycle times due to cylinder's lightness and increase productivity," Abbott notes, before asking us to compare the weight of J cylinder and its CM2 predecessor.

Moving to a nearby display, he shows us a simple initiative linked to right-sizing actuators to save energy. "We have always manufactured pistons in 40, 50 and 63, 80 and 100 mm sizes. We have now added intermediate sizes, though, 45, 56, 67 and an 85 mm. This allows customers to select a cylinder that will provide exactly the right force for their application. This saves energy because it avoids having to oversize a cylinder to achieve the force required. To move 95 kg, the 40 bore may not have been quite enough, but the next available size was 50 mm, which would be



SMC´s optimised J Cylinders are 11% shorter in length; weigh 27% less and have 30% less volume than their CM2 series equivalents.

too big. By introducing the 45 bore cylinder the cylinder can be right-sized for the 95 kg application, without consuming unnecessary additional air," Abbott explains

"This is where SMC is very strong. We go outside the norm and create products that are tailormade for their application," he says.

SMC's VBA Booster regulator is another simple innovation designed to overcome oversizing at plant level. Most pneumatic air lines in production facilities operate at 3 bar (0.3 kPa). But plants often have one or two cylinders that need more, 6 or 12 bar for example, to perform their moving, clamping or forming function.

"This pressure booster system uses only incoming compressed air and a clever arrangement of pistons to double or quadruple the available pressure. So a higher-pressure application can be run without having to increase the line pressure of the whole system.

How does it work? "Two pistons are coupled together to move in sync under plant pressure. These are used to further compress the air on the outlet side of a single piston, creating double or quadruple the supply pressure. So while we call this a pressure booster, it is really a mini compressor being run off lower pressure compressed air," Abbott explains. "The higher pressure is only generated when needed, so the supply pressure need not be increased to accommodate one or two higher pressure needs," he adds.

Another plant-wide energy saving strategy is to reduce the pressure on the return side of pneumatic actuators. This can typically reduce total air consumption by 25%. "SMC has developed fittings that can be easily added to existing cylinders, which reduce the air consumption in one of the stroke directions. If a box on a conveyor needs to be pushed off by a cylinder, then the working force is only needed in one direction. That same high force is not needed to retract the cylinder. What our fittings do is to reduce the pressure for the return stroke, which uses less air and, therefore less energy.

"A flow control regulator is integrated into the return stroke of the piston, so the piston speed need not be slower. We generally set the return pressure at 2.0 bar, which is one bar higher than the minimum pressure required and will still generate enough force to move a light load," Abbott says.

"Every customer should be buying these. Many sites have expanded their production capacities without having upgraded their compressed air infrastructure. By adopting plant-wide energy savings such as these, the existing capacity can be stretched much further, avoiding the need for an expensive upgrade," he notes.

Abbott then moves across to a vacuum technology demonstration. "Vacuum technology is routinely used on assembly lines, for example, to pick up components using vacuum and move them to where they are needed.

Vacuum systems use a Venturi effect to generate the vacuum. Compressed air flowing through a constriction at supersonic speed expands and slows down when exiting the restriction. Air in the vacuum line is drawn into this low-pressure stream via a vacuum port, creating the suction necessary to grip the component.

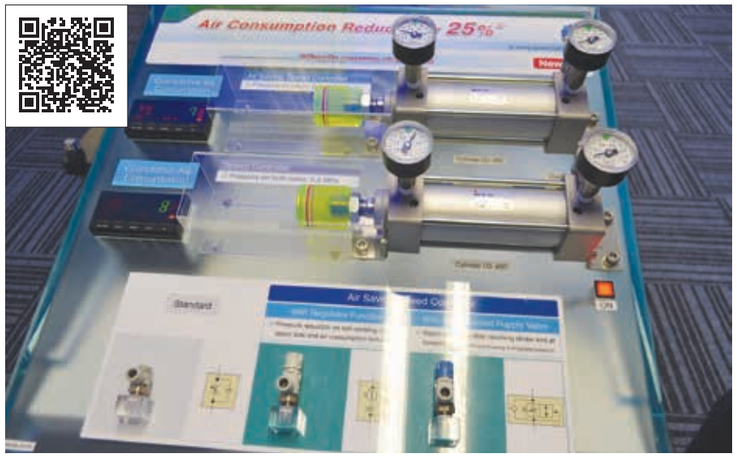
"But the vacuum is only generated while compressed is being consumed, so traditional systems consume continuously," notes Abbott. "For many applications, it is possible to pick up a product and then trap and hold the vacuum. This allows the compressed air to be turned off, saving significant amounts of energy.

"With our ZK2 Vacuum Ejectors, this is exactly what is done. Once the vacuum has been established and the component is lifted, we seal off the vacuum line to hold that negative pressure. We can then shut off the compressed air until we need to create a vacuum again."

Demonstrating the system, he shows how the air consumption gauge is high until the suction pad engages with its target. The airflow immediately shuts off and the consumption drops to zero. "Since all vacuum systems have some leakage, the system automatically reactivates if the vacuum drops below a critical level. 40%, for example," he says, while switching over to a porous workpiece. The system can be heard pulsing to maintain the vacuum needed to keep the gripper in place.

"Compared to a traditional system that runs the compressed air continuously, holding the vacuum in this way can result in energy and air savings of as much as 90%," Abbott notes.

"These products all demonstrate SMC's commitment to continuously bring products to market that are energy-efficient, reduce our carbon footprint and save money, without sacrificing any of the modern benefits and features associated with pneumatic products," Abbott concludes. ❑



A flow control regulator integrated into the return stroke of the piston reduces the pressure on the non-working stroke, reducing air consumption by 25%. ***Scan QR code to view Part one of video.***

With SMC's ZK2 Vacuum Ejectors, once a vacuum has been established and the component is lifted, the vacuum line is closed off to hold that negative pressure. The airflow across the Venturi can then be switched off, which enables energy and air savings of as much as 90%. ***Scan QR code to view Part two of video.***

For mobile equipment, for example, SMC's compact J cylinders offer 63% overall length reduction and 53% weight reduction, so less energy is required to carry and move the cylinder, while installation space is reduced by a third.