HELPING TO KEEP YOUR BUSINESS FLOWING

FLUID HANDLING INTERNATIONAL

SPRING EDITION 2026

Issue 2 Volume 14

Flow control

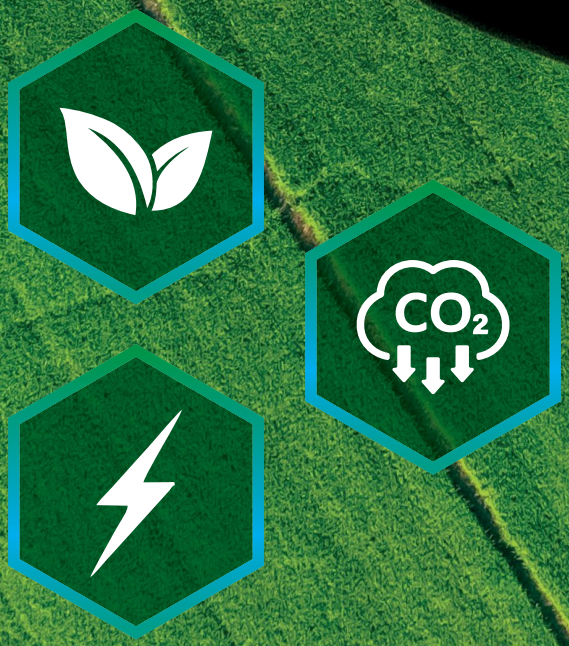
Advancing valves and pumps for plant optimisation

Critical infrastructure

Reliable fluid systems powering global industries

Global e-Fuels

Is Your Company Helping Shape the Future of Power-to-X?



For more information please contact James Patterson
james@woodcotemedia.com, +44 (0) 203 778 2385

global-efuels.com

Let's shape the future of e-fuels together.

FLUID HANDLING INTERNATIONAL

SPRING EDITION 2026

ISSUE 2 • VOLUME 14

Woodcote Media Ltd
Kamp House
124 Middleton Road,
Morden,
Surrey SM4 6RW, UK
www.fluidhandlingmag.com

MANAGING DIRECTOR
Peter Patterson
Tel: +44 (0)20 8648 7082
peter@woodcotemedia.com

GROUP MANAGING EDITOR
Anamika Talwaria
Tel: +44 (0)20 3778 2398
anamika@woodcotemedia.com

EDITOR
Paul Warner
Tel: +44 (0)20 8687 4126
paul@woodcotemedia.com

EDITOR
Thomas Daldry
Tel: +44 (0)208 687 4139
tom@woodcotemedia.com

INTERNATIONAL SALES MANAGER
Joe Pate
Tel: +44 (0)203 778 2397
joe@woodcotemedia.com

PRODUCTION
Alison Balmer
Tel: +44 (0)1673 876143
alisonbalmer@btconnect.com

SUBSCRIPTION RATES
A one-year, 4-issue subscription costs £160 (approximately €225/$270 depending on daily exchange rates). Individual back issues can be purchased at a cost of £30 each

Contact: Lisa Lee
Tel: +44 (0)20 8687 4160
Fax: +44 (0)20 8687 4130
marketing@woodcotemedia.com

Join Fluid Handling International on Linkedin to discuss important issues

Follow us on X: @FluidHandlntl

ISSN 2399-5602

Picture from bigstockphoto.com
©AvigatorPhotoGrapher

Don't miss out on future editions. Head to **www.fluidhandlingmag.com** to subscribe to *Fluid Handling International*, and read a free copy online

Navigating disruption, innovation and a shifting global landscape

In this issue of *Fluid Handling International,* we turn our attention to the chemical and petrochemical sectors: industries that quietly underpin almost every aspect of modern life. From solvents used in agriculture and the fuels that keep global logistics moving, these sectors form the backbone of industrial progress. Yet today, they are being reshaped by external forces. The recent escalation in tensions between the US and Iran has sent shockwaves through global energy markets. With oil and gas prices climbing sharply, chemical and petrochemical producers, already operating in energy intensive environments, are facing mounting operational costs. This volatility has tightened margins and it has forced companies to rethink energy strategies.

Alongside geopolitical instability, the global march toward decarbonisation continues to accelerate. However, reducing emissions in sectors built on high temperature processes and fossil-based feedstocks is no small feat. Companies are being pushed to innovate while simultaneously maintaining output, safety and profitability. It's a balancing act that demands new technologies, new partnerships and in many cases, entirely new business models. This summer's global trade shows will give manufacturers of pumps, valves, seals and flow control systems the opportunity to showcase technologies designed to meet the sector's new realities: higher energy costs, stricter environmental standards and the need for smarter, more efficient fluid handling equipment. In this edition, we explore challenges and breakthroughs in depth, offering insights into the technologies, strategies and market forces shaping the future of fluid handling. For ongoing updates, visit fluidhandlingmag.com.

Paul Warner
Editor

DAB expands FX range with compact, clog-resistant FXS

DAB Pumps has launched the latest addition to its trusted FX range of wastewater pumps, the FXS, a robust, compact submersible pump designed for residential, commercial, industrial and agricultural applications.

Built for lifting and transferring wastewater and sewage, the FXS combines the reliability contractors expect from the FX range with a more compact design that makes positioning and servicing straightforward.

It features a non-clog screw impeller that delivers excellent hydraulic efficiency, performing reliably even in narrow pipework or systems prone to blockages.

The FXS efficiently transfers wastewater containing solids thanks to its 50 mm free passage and meets EN 12050-1 standards for wastewater handling. Durable construction comes as standard, including a double silicon carbide mechanical seal fully enclosed in an oil chamber, an anti-corrosion stainless steel motor shaft and a hard-wearing two-component coating for strong protection even in aggressive environments.

Like other pumps in the range, the FXS uses a three-level structure that allows quick access to all key components.

Spare parts are also universal across the FX range, simplifying servicing and reducing downtime.

Compact, high-torque motors improve starting performance and help prevent clogging, while also allowing the pump to run without being fully submerged to completely empty tanks when required.

KROHNE launches OPTIWAVE 1530 and 1560 for precise solids and liquid measurement

KROHNE has released the OPTIWAVE 1530 and OPTIWAVE 1560 radar FMCW level transmitters for solids and liquid applications.

This technology provides an ideal solution across industries such as water and wastewater, delivering accurate, non-contact measurement of solids and liquids.

The OPTIWAVE 1530 provides a cost-effective solution with a measuring range of 0–15 m, making it well-suited for small to medium silos, stockpiles, bunkers and tanks.

The OPTIWAVE 1560 extends this capability to 30 m for long-range measurement in tall silos, large tanks and deep vessels.

Both models deliver drift-free, maintenance-free operations without the need for recalibration over the lifetime of the product, significantly reducing total cost of ownership.

Built for durability, both models feature a compact, robust design with fully potted electronics to protect internal components from dust, condensation, vibration and shocks.

The flush-mounted, concave PVDF lens antenna offers excellent chemical resistance and a self-draining design to prevent build-up, maintain a stable radar signal and ensure consistent performance, even with condensation present.

Johnson Matthey opens Gothenburg facility to accelerate hydrogen mobility

Johnson Matthey (JM) has officially opened its first hydrogen internal combustion engine (H2ICE) facility, where cutting-edge emission control systems will be tested.

JM has developed the new centre of excellence to strengthen its world-class heavy-duty testing capabilities.

H_2ICE uses zero-carbon hydrogen fuel in tried-and-tested engine technology, presenting a viable path for decarbonising industries.

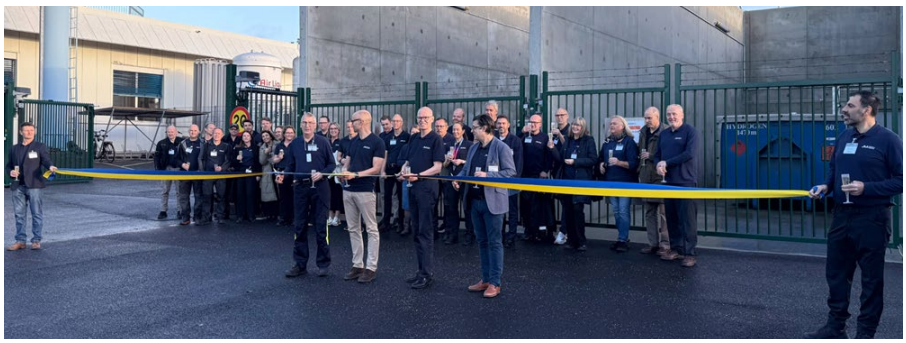
The new testing area forms part of JM's existing site in Gothenburg, Sweden.

Tauseef Salma, chief technology officer in clean air at JM, said: "This investment shows JM is backing H_2ICE as a ready-to-go technology that will enable mobility partners to meet their decarbonisation and climate goals.

"Our state-of-the-art Gothenburg facility positions JM as a world leader in sustainable technology solutions, transforming energy and reducing carbon emissions."

The new Gothenburg installation supports H_2ICE engines up to 600 kW (800 hp).

It will test the performance of catalysts within the wider engine after-treatment and control systems, providing key insights into the development of hydrogen mobility solutions.



TotalEnergies further expands natural gas production in the US

TotalEnergies has signed an agreement with Continental Resources to acquire a 49% interest in natural gas-producing assets owned and operated by Continental Resources in the Anadarko Basin, Oklahoma.

This acquisition of low-cost, long-plateau assets, well connected to Henry Hub through existing midstream infrastructure, further strengthens TotalEnergies' integration across the liquefied natural gas (LNG) value chain in the US.

These assets have the potential to reach a gross production of around 350 million standard cubic feet per day (MMscfd) by 2030 and to sustain this production level over the long term.

They will enable the company to secure a net gas production of around 150 MMscfd.

This acquisition of non-operated shale gas assets complements the Dorado and Constellation acquisitions completed in 2024 in the Eagle Ford Basin.

In addition, TotalEnergies operates a technical production of around 500 MMscfd in the Barnett.

"This acquisition will further increase our natural gas production in the United States and consolidate TotalEnergies' integrated LNG position with a competitive low-cost and low-emission gas production," said Nicolas Terraz, president, exploration and production at TotalEnergies.

Greene Tweed sets new benchmark in hydrogen compression

Greene Tweed has achieved a significant advancement in hydrogen compression technology.

The company's newly engineered composite closed impeller set a record-breaking tip speed of 688 m/s in testing, nearly double that of traditional metallic impellers.

The innovation highlights the potential of advanced composite materials to enhance performance, reduce costs and improve efficiency in critical hydrogen pipeline infrastructure, specifically the transportation, storage and utilisation market segments.

Transporting hydrogen through pipelines requires large centrifugal compressors to maintain pressure.

Conventional metallic impellers typically operate at speeds of up to 360 m/s for closed designs and 500 m/s for open designs before burst, limiting the achievable compression ratio for lighter gases and requiring more compressor stages, increasing system size, cost and maintenance requirements.

With Europe planning tens of thousands of kilometres of hydrogen pipelines by 2040, the demand for faster, more durable and cost-effective compressor technology is surging.

"Greene Tweed began developing its composite closed impeller in 2020, leveraging the high specific strength and temperature resistance of carbon fibre reinforced PEEK (C/PEEK).

"Our goal was to create a design that could exceed 600 m/s tip speed for compressing light gases like hydrogen," said Samuel Stutz, technology manager at Greene Tweed.

"After three rigorous development and testing cycles, the impeller achieved a tip speed of 688 m/s, far exceeding the project's original target and setting a new industry benchmark."

Greene Tweed's composite closed impeller design offers several key advantages.

It is lightweight, up to five times lighter than conventional metallic impellers, while offering three times the strength-to-weight ratio.

This design also boosts efficiency, as higher operational speeds improve hydrogen compression, supporting global clean energy goals.

Strategies to boost performance

Mike Easson, chief technology officer at John Crane, speaks to *Fluid Handling Magazine* about how the company is rethinking engineering innovation to help operators meet rising performance expectations while hitting increasingly ambitious sustainability targets

Mike Eason, chief technology officer at John Crane

How is John Crane's innovation strategy evolving to help customers meet both performance demands and increasingly aggressive sustainability targets?

Industrial operators are no longer balancing performance and sustainability as separate priorities. Today, they are expected to deliver both simultaneously; higher throughput and lower emissions, often from assets that have been in operation for decades. This shift is fundamentally changing how engineering innovation is approached.

At John Crane, we see innovation not as improving individual components, but as optimising the performance of the entire rotating system. Seals, power transmission couplings, filtration systems and digital monitoring all influence how efficiently a pump or compressor operates.

When these elements are engineered and managed together, incremental gains in efficiency, reliability and leakage control compound into meaningful operational and environmental improvements.

Energy use is a good example. Pumps and compressors account for a large share of industrial electricity demand globally. Even modest improvements in friction, leakage control or power transmission can reduce energy consumption across thousands of operating hours.

Sustainability targets have accelerated this thinking. Operators are increasingly seeking solutions that improve reliability and reduce emissions without requiring a complete redesign of their assets. That means engineering innovations, which remove inefficiency from systems already operating in the field, often delivered through integrated service frameworks such as John Crane Performance Plus.

One of the most important enablers of this approach is the insight we gain from our global engineering footprint. The company has reliability and service engineers embedded with customers worldwide, working directly on rotating equipment in real operating environments. That proximity gives us a deeper understanding not just of the seal, but of the entire system in which it operates.

Those real-world insights feed directly into our innovation process, helping us develop solutions that are grounded in operational reality. It also strengthens our product development pipeline, ensuring both new and existing technologies continue to evolve in line with customer needs.

Many operators are under pressure to decarbonise quickly. How significant is the sustainability impact of retrofitting existing equipment with modern sealing technologies compared to full system replacements?

Retrofitting is often the fastest route to measurable emissions reductions. Large industrial plants rely on equipment designed to operate for decades and replacing entire compressor systems can take years of planning and investment.

Sealing upgrades can deliver impact far more quickly. Older wet seal systems rely on oil lubrication and complex support infrastructure. Modern dry gas seals operate using a thin gas film between the seal faces, which significantly reduces leakage and removes the need for oil systems.

In many compressor applications, replacing wet seals with dry gas seals can cut methane and fugitive emissions by up to 95%. Across large installations, this can translate into major reductions in carbon dioxide equivalent emissions each year.

For example, in LNG operations, upgrading legacy sealing systems to modern dry gas seal technology has helped operators significantly reduce methane emissions while improving compressor reliability and eliminating the need for complex oil support systems.

This principle extends beyond compressors. Improvements in pump sealing technology across chemical processing, refining and water infrastructure can reduce leakage, extend equipment life and lower maintenance demands. When these upgrades are deployed across large installed bases, the cumulative environmental benefits are significant.

How are digital diagnostics changing the way customers manage reliability, emissions and energy efficiency across industrial operations?

For decades, industrial reliability depended largely on scheduled inspections and maintenance intervals. However, mechanical systems rarely fail according to a timetable.

Digital diagnostics enable operators to understand how equipment behaves continuously during operation. Sensors embedded within sealing systems can monitor parameters such as temperature, pressure, vibration and acoustic signatures. Over time, that data reveals patterns that indicate developing issues before failure occurs.

This is where predictive maintenance becomes valuable. Instead of discovering a problem after a failure occurs, operators can identify abnormal conditions early and intervene during planned maintenance windows.

The benefits extend beyond reliability. Equipment operating outside its optimal range often consumes more energy and may allow increased leakage. Early detection helps maintain efficiency and reduce emissions events.

This is why we have invested heavily in developing digital solutions such as John Crane Sense Turbo, which provide that level of visibility. In LNG and gas compression applications, these systems have enabled

operators to detect abnormal behaviour early in their assets and manage reliability, energy use and environmental performance with far greater precision.

What role do advanced and smart materials play in extending equipment life while reducing leakage, waste and overall environmental footprint?

Material science is often the hidden driver behind improvements in industrial reliability. Seals operate in environments defined by high pressures and extreme temperatures. The materials used at the sealing interface determine how long equipment can run without degradation.

Over the past few decades, there have been major advances in carbon composites, ceramics and specialised alloys. These materials maintain dimensional stability under demanding conditions, reducing wear and improving leakage control.

The environmental implications are straightforward. A seal that lasts longer requires fewer replacements and fewer maintenance interventions. That, in turn, reduces material consumption, manufacturing demand and operational downtime.

Advanced materials also allow equipment to operate in environments that were historically difficult to manage. Compressors in modern LNG and hydrogen applications run across wide temperature and pressure ranges that demand extremely stable sealing surfaces.

Many of the reliability gains seen in rotating equipment over the past 20 years have been enabled by progress in materials engineering.

At John Crane, this remains a major area of focus. We are continuing to invest in advanced research, including PhD programmes focused on developing new materials and optimising the tribological behaviour of seal face surfaces. These efforts are helping to further improve wear resistance, reduce friction and extend operating life in increasingly demanding applications.

This work in advanced materials naturally extends into emerging applications such as hydrogen, where material performance under extreme conditions becomes even more critical.

> **"For example, in LNG operations, upgrading legacy sealing systems to modern dry gas seal technology has helped operators significantly reduce methane emissions while improving compressor reliability and eliminating the need for complex oil support systems"**

Hydrogen and carbon capture pose unique sealing challenges. How is John Crane engineering solutions that enable these technologies to scale safely and economically?

Hydrogen molecules are extremely small, which inherently increases leakage risk. Carbon capture processes introduce high pressures and rapidly changing thermodynamic conditions. Both demand sealing technologies purpose-built for their environments.

In hydrogen compressors, sealing systems must manage high rotational speeds while maintaining extremely tight leakage control. Material compatibility is equally critical because hydrogen can cause embrittlement in certain metals, degrading their mechanical properties.

To address this, we have been actively testing and evaluating materials for their resistance to hydrogen embrittlement, particularly in high-stress applications. This is a key technical challenge in enabling hydrogen infrastructure to scale safely and reliably.

Carbon capture introduces a different set of challenges. Compressors handling dense phase carbon dioxide must perform reliably across fluctuating pressure and temperature conditions while maintaining containment.

Addressing these challenges requires rigorous testing and close collaboration with equipment manufacturers and operators. Ultimately, the goal is to ensure sealing technology supports the safe and efficient scaling of emerging energy infrastructure. As hydrogen and carbon capture scale globally, reliable rotating equipment will be an essential enabler.

Looking ahead, what do you see as the most transformative engineering innovation John Crane will deliver in the next decade to support a low-carbon industrial world?

One of the most important developments will be the integration of mechanical engineering with real operational data. Industrial equipment is becoming increasingly connected, creating a continuous feedback loop between how equipment performs in the field and how it is designed and improved.

Data from sensors embedded in seals, couplings and filtration systems can reveal how equipment behaves across thousands of operating hours. When that information feeds back into engineering design, it accelerates the pace of improvement.

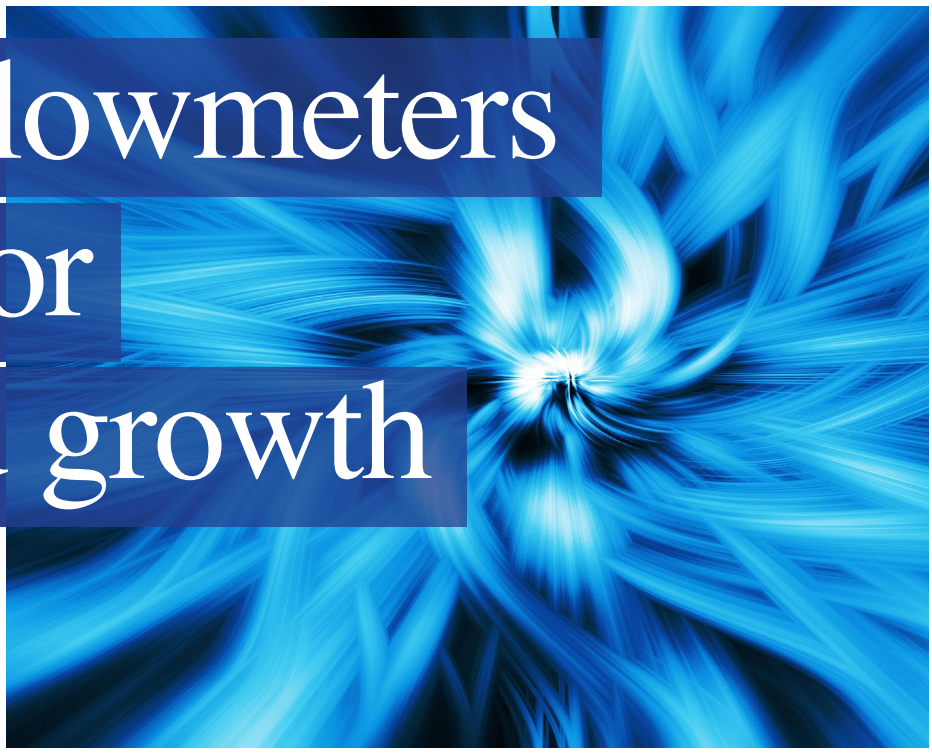
Another area of focus is lifecycle engineering. Operators want solutions that improve reliability and efficiency across the full life of an asset rather than optimising for initial performance alone. That approach combines product development, digital monitoring and global service capability.

Improving the efficiency and reliability of these components may seem incremental. Yet, across global industrial infrastructure, those improvements deliver substantial reductions in energy consumption and emissions.

A natural gas production plant with pipeline valves

For more information:
Visit johncrane.com

Vortex flowmeters poised for renewed growth



Flow Research says its latest global study reveals a market on the brink of transformation

Flow Research has tracked vortex technology since 2001, and its latest study, *The World Market for Vortex Flowmeters*, places particular emphasis on multivariable vortex meters and the growing integration of pressure and temperature sensors for mass flow calculation.

As end users expand steam measurement and face rising demand for natural gas and other gases, mass flow capability is becoming increasingly critical.

This latest edition places particular emphasis on the rapid evolution of multivariable vortex technology and the increasing integration of pressure and temperature sensors to support mass flow measurement.

An oil and gas industrial setting where vortex flow measurement plays a key role in monitoring fluid and energy flows

A mature technology with enduring strengths

Vortex flowmeters, first commercialised in 1969, have earned a reputation for versatility, reliability and accuracy across liquids, gases and steam.

Their ability to withstand the high temperatures associated with both saturated and superheated steam has made them a mainstay in energy and process industries.

Many modern devices now achieve accuracy better than one per cent, depending on the application, while maintaining favourable costs of acquisition, commissioning and long term ownership.

> **"As end users expand steam measurement and face rising demand for natural gas and other gases, mass flow capability is becoming increasingly critical"**

These attributes continue to underpin their appeal in a competitive flow measurement landscape.

Market conditions favouring expansion

Although the vortex market has experienced periods of slow growth, Flow Research has identified clear signs of renewed momentum.

More suppliers are entering the field, and global demand for gas measurement is rising steadily.

The American Petroleum Institute's approval of API 14.12, which permits vortex meters for single phase gas and steam custody transfer, has further strengthened market confidence. Suppliers are now developing products that conform to the standard, accelerating innovation and broadening the technology's commercial reach.

Innovation reshapes the competitive landscape

The study highlighted a wave of technical advancements that have transformed the market in recent years. These include anti-vibration electronics,

Process industry infrastructure illustrating the environments in which modern flow measurement technologies are widely used

An example of equipment found in applications that rely on accurate and reliable flow monitoring across liquids, gases and steam

multivariable designs, reduced bore meters, plastic body instruments and enhanced digital signal processing.

With more than 50 suppliers now active worldwide, customers have a wider range of options than ever before when specifying or purchasing vortex flowmeters.

This diversity has intensified competition and encouraged suppliers to differentiate through performance, reliability and advanced diagnostics.

Reduced bore designs address low flow challenges

Historically, vortex flowmeters have struggled to measure low flow rates due to the weaker vortex signals generated at lower velocities.

Recent developments in reduced bore designs have significantly improved performance in this area. By narrowing the bore, suppliers have created stronger, more stable vortex signals, enabling more accurate low flow measurement.

Both single line size and dual line size reduced bore configurations have gained traction, reflecting end users' growing need for precision across a wider flow range.

The expanding role of multivariable Vortex flowmeters

Multivariable vortex technology, first introduced commercially in the 1990s, continues to gain prominence. By combining vortex detection with integrated temperature and pressure sensors, these instruments can output volumetric flow, temperature, pressure, fluid density and mass flow.

This capability is particularly valuable in applications where temperature and pressure fluctuate, such as steam and gas systems. Although multivariable devices are more expensive than single variable models, they provide significantly richer data and are contributing to overall market growth. Suppliers offering multivariable designs now include Emerson, ABB, Yokogawa, KROHNE and Endress+Hauser.

As industries place greater emphasis on reliability and measurement certainty, suppliers have introduced redundant configurations to meet these expectations. These include single shedder bars equipped with dual sensors and paired vortex meters installed in tandem within the flow stream. While traditional single sensor designs remain dominant, Flow Research found that users increasingly recognise the value of redundancy, particularly in critical applications where uptime and accuracy are paramount.

Vibration issues mitigated through advanced electronics

Vibration interference has long been a challenge for vortex flowmeters, with pipeline vibrations capable of generating false signals or distorting existing vortex patterns. Suppliers have responded with advanced software, digital signal processing and improved electronics that significantly reduce susceptibility to vibration.

These enhancements have strengthened confidence in vortex technology, particularly in environments where mechanical vibration is unavoidable.

Vortex flowmeters operate on the von Kármán effect, a principle describing the alternating vortices that form when a fluid passes an obstacle. In a vortex meter, this obstacle takes the form of a bluff body mounted perpendicular to the flowstream.

The frequency of vortex shedding is proportional to flow velocity, allowing the meter to calculate flow rate by multiplying velocity by pipe area. Most devices use piezoelectric sensors to detect vortices, though capacitive and ultrasonic sensing technologies are also employed. This simple yet robust principle has contributed to the technology's longevity and reliability.

Strong prospects for the decade ahead

Flow Research has concluded that vortex flowmeters are well positioned for sustained growth. The combination of expanding supplier participation, rising demand for gas measurement, and ongoing technical innovation is reshaping the market.

With their long standing strengths including accuracy, durability and cost effectiveness, now complemented by multivariable capabilities, reduced bore designs and improved vibration resistance, vortex flowmeters are entering a new phase of relevance across global process industries. ▮

For more information:
Visit flowresearch.com

Increasing reliability

Josh Liford, Wanner International's assistant product marketing manager, outlines why it is important to maintain reliable metering in high-pressure and abrasive applications

Industrial dosing systems frequently operate at high pressures while handling abrasive, corrosive or particle-laden liquids. This article examines how multi-diaphragm, seal-less metering pump designs support reliable operations in demanding process environments.

Maintaining precise liquid control is challenging in applications such as chemical dosing, water treatment and industrial manufacturing.

Metering pumps used in these environments must operate continuously while handling abrasive particles, corrosive solutions, or wide flow rate requirements.

These conditions place significant demands on pump design, particularly in achieving reliable operation with zero leakage and minimal maintenance requirements.

Popular option

Hydraulically balanced seal-less multiple-diaphragm pumps are increasingly used to address these challenges by reducing wear and supporting stable, long-term operation.

A recent pilot project illustrates these challenges. An engineering company developing a waste-treatment process required a dosing pump capable of operating across an extremely low flow range of 0.5–5 l/hr while injecting water and effluents at pressures up to 240 bar (3500 psi). The liquid also contained up to 10% by volume solids from crushed circuit boards, with particle sizes as high as 200 µm in diameter.

Initial trials using a conventional metering pump failed when these solids settled in the valves, causing blockage and loss of operation. The installation was subsequently modified to use one of Wanner's multiple-diaphragm pumps, resulting in stable, repeatable operation. This demonstrates how pump design directly affects reliability when handling abrasive liquids at very high pressures.

Design requirements for stable metering performance

Flow accuracy and repeatability are central requirements for metering pumps used in critical dosing operations. In many industrial processes, metering pumps must ensure consistent output across a wide pressure range while operating under varying suction conditions. In some cases, this may involve discharge pressures of up to 240 bar (3500 psi) while still delivering steady flow.

Achieving this level of stability depends on several design features, including control of volumetric efficiency and precise regulation of hydraulic liquid supporting the diaphragm. These mechanisms help ensure accurate dosing across different flow rates, including low-output operations, while maintaining linear flow characteristics. Such stability is particularly important in applications operating continuously, where even small variations in flow can accumulate over time and affect overall process performance.

Operational advantages of seal-less pump designs

The advantages of Hydra-Cell Pro seal-less pumps are particularly evident in chemical dosing applications where accurate control is critical.

Hydraulically balanced seal-less multiple-diaphragm pumps are getting more popular with customers

Maintaining a consistent, low-pulse flow helps achieve precise metering and stable process conditions.

Hydra-Cell Pro pumps deliver steady-state flow rate control across a wide range of flow rates, supporting reliable dosing performance. Their unique valve design contributes to consistent volumetric efficiency and reliable operation across a wide range of conditions. They can also handle corrosive or abrasive fluids, helping maintain accuracy even in demanding environments.

Engineers at a manufacturing plant required a single pump capable of handling dosing, transfer and cleaning duties within a demanding process environment.

Previous equipment, including a PTFE-lined magnetic drive pump, was unreliable and costly to maintain, leading to consideration of alternative technologies.

A Wanner multiple-diaphragm pump was selected to provide more robust and flexible performance across a wide range of liquids, including acids, alkalis and solvents at temperatures from ambient up to 90°C.

Additional characteristics associated with the company's pump designs support flexible operation. These include the ability to maintain consistent flow independent of pressure, wide turndown ratios (over 100:1), low shear and tolerance of dry running conditions.

The patent Advance Diaphragm Position Control (ADPC) keeps the diaphragms in a safe condition if the pump is started with a blocked in let, or if an operator accidently closes a suction isolation valve on a running pump, ensuring security of process.

Together, these features allow the pumps to adapt to varying process demands while maintaining reliable metering performance. High pump efficiency (up to 90%) further supports overall system performance.

Reliability and maintenance in continuously operating systems

Reliability and maintenance are critical factors in metering applications that operate continuously. Seal-less diaphragm designs eliminate dynamic seals, removing the problems associated with seal and packing wear and extending service intervals. In some installations, pumps have operated for more than 15 years with very long intervals between scheduled services.

The ability to run dry without damage reduces risk during start up, shutdown, line blockage, operator error or other challenging conditions. In addition, the use of multiple diaphragms within a single pump head helps minimise pulsation and limits stress on connected system components. So, there is no need for pulsation dampers in most applications, reduces Ha, and minimises cost and installation/ maintenance requirements.

These outcomes depend largely on pump design. Flow stability, material selection and seal-less operation determine how effectively a pump can handle different liquids and pressures while ensuring accurate dosing. Wanner's compact designs also reduce overall material usage, which can lower cost, particularly in applications requiring expensive pump head materials.

The Hydra-Cell Pro pump used today originates from designs developed and patented in the 1970s by inventor William F. Wanner.

The design is purpose built to handle difficult liquids especially hazardous and those containing suspended solids and abrasives. Early versions were capable of flow rates up to 1800 lph at pressures of up to 70 bar (1,000psi).

This robust design platform has been the basis for the continued development of unique patented technology especially around the control and management of the hydraulic liquid supporting the diaphragms ensuring high performance metering.

These design principles continue to underpin pump performance in demanding industrial applications and are evident in the following applications.

Example from an industrial installation

A company in the United States selected one of Wanner's pumps for an environmentally sensitive operation involving the injection of cyanide concentrate to form a weak cyanide solution, which was then delivered into a high-volume water stream. Pumps previously used in the application experienced seal failures, resulting in leakage, unplanned maintenance, production losses and potential safety concerns from the exposure to the hazardous chemicals.

The seal-less, multiple-diaphragm design of the pumps eliminated leakage associated with dynamic seals, whilst maintaining a compact installation and smooth low pulse flow.

The design of a metering pump directly affects its performance and suitability for demanding applications. As the examples above demonstrate, factors such as flow accuracy, material compatibility, pressure capability, compact/simple installation and maintenance requirements all influence how reliably a pump can operate in these process conditions.

By addressing these design considerations, Wanner Hydra-Cell Pro metering pumps provide stable operation and accurate dosing even under the challenging conditions commonly encountered in modern industrial environments.

A metering pump in-situ

For more information:
Visit wannerpumps.com/en-gb

Recovering value from hydrogen streams

Divyam Mandalia, director of global purification at PSB Industries, takes a deep dive into the role of advanced oxygen removal in chlor-alkali processing

Chlor-alkali production is among the most energy intensive processes in the chemical industry. Through electrolysis, sodium chloride is converted into chlorine and caustic soda, with hydrogen generated as a byproduct. Historically, that hydrogen stream was often treated as secondary, used internally where possible or vented when purification requirements made recovery impractical.

That mindset has shifted. Producing hydrogen, especially at usable purity levels, has become increasingly expensive, regardless of whether the end use is fuel, feedstock, or resale. Venting hydrogen is no longer viewed as a neutral operational choice; it represents lost value. As a result, chlor-alkali operators are reassessing how effectively they capture, clean and reuse hydrogen generated within their own processes.

This shift has elevated gas purification from a downstream afterthought to a core efficiency lever. The challenge is not simply capturing hydrogen, but refining it to meet downstream requirements without introducing new inefficiencies or hidden losses elsewhere in the system.

Full-scale chlor-alkali purification towers ensure hydrogen meets ultra-low oxygen and moisture limits ahead of downstream PSA units

Why hydrogen purity and how it's achieved, matters more than ever

Hydrogen produced from electrolysis processes is not clean by default. Oxygen and moisture are intrinsic byproducts of the process and trace contaminants such as carbon dioxide, carbon monoxide and halogenated species are often present as well.

While concentrations may be low, their impact downstream is significant. Many chlor-alkali facilities route hydrogen through pressure swing adsorption systems or other polishing steps to meet final purity specifications. These systems are sensitive to oxygen content. Higher oxygen levels reduce hydrogen recovery, increase purge losses and place greater stress on adsorption media. In practical terms, facilities may sacrifice a meaningful percentage of usable hydrogen simply to remove oxygen later in the process.

Several purification technologies are commonly applied upstream, including membranes and PSA-based approaches. While effective for bulk separation, these technologies struggle when tasked with removing oxygen to very low outlet concentrations. Their efficiency declines sharply at the trace level, where removal must occur at parts-per-million thresholds rather than percentage points. Catalytic oxygen removal, often referred to as Deoxo purification, addresses this limitation directly.

Instead of separating oxygen from hydrogen, catalytic systems convert oxygen into water through controlled oxidation. This approach enables near complete oxygen removal, often down to one part per million by volume or lower, without relying on adsorption capacity or purge-intensive operation.

As the reaction itself generates water, high performance drying becomes a necessary companion technology. Advanced dryer systems remove the resulting moisture to similarly low levels, ensuring the hydrogen stream meets downstream requirements without shifting the burden of impurity removal further along the process. Together, catalytic oxygen removal and deep drying form a purification strategy optimised for trace-level control rather than bulk correction.

Regeneration strategy, hydrogen recovery and downstream performance

Dryer systems operate cyclically. As desiccant beds become saturated, they must be regenerated by desorbing moisture from the media. That regeneration step typically relies on a slipstream of process gas, which is heated and routed through the saturated bed.

In many systems, regeneration occurs at reduced pressure. While technically effective, depressurisation introduces gas losses that are easy to overlook, particularly when hydrogen is viewed as a secondary stream. Over time, however, these losses accumulate. Each regeneration cycle represents hydrogen that is vented rather than recovered, quietly eroding overall process efficiency.

Operating regeneration at full system pressure eliminates this inefficiency. By

maintaining pressure during regeneration, hydrogen remains within the process instead of being lost through venting. Although high pressure regeneration can increase capital cost, its lifecycle impact is often decisive. When evaluated over five or 10 years of operation, avoided hydrogen losses frequently outweigh the initial investment.

The benefits of advanced oxygen removal extend beyond the dryer itself. By reducing oxygen levels upstream, facilities can dramatically improve the performance of downstream PSA systems. Lower oxygen concentrations lead to higher hydrogen recovery, reduced purge requirements and longer adsorption media life.

Equipment operates under more stable conditions, maintenance intervals extend, and total cost of ownership declines. In some applications, the addition of dedicated oxygen removal has paid for itself in less than a year through improved hydrogen recovery alone. In this context, purification is no longer a cost centre, it becomes a recovery strategy that protects the value of hydrogen already produced.

Integration without disruption

One barrier to adopting advanced purification technologies is concern over integration. Chlor-alkali facilities often operate with tightly controlled automation standards and introducing new equipment must not disrupt existing control architectures. Modern purification systems should be designed with this reality in mind.

Controls can be aligned with plant standards, whether Allen-Bradley, Siemens, or other platforms, ensuring seamless communication with upstream and downstream equipment. This flexibility allows purification systems to be added or upgraded without forcing broader control system changes.

The ability to adapt to evolving project requirements is equally important. In facilities where specifications may run into hundreds of pages, or where design changes emerge mid-project, close coordination between engineering, fabrication and commissioning becomes a practical necessity rather than a nice to have.

These efficiency driven approaches are increasingly visible in how companies like PSB Industries support hydrogen purification in chlor-alkali applications. By combining catalytic oxygen removal with high performance drying and zero-gas-loss regeneration, PSB Industries focuses on maximising hydrogen recovery while minimising operational waste.

Its vertically integrated design and fabrication model enables rapid adaptation to project specific requirements and close alignment between engineering intent and shop floor execution. For operators balancing legacy infrastructure with evolving performance expectations, that flexibility can be as valuable as the purification technology itself.

Turning purification into a strategic advantage

As hydrogen continues to gain importance across chemical processing and energy markets, chlor-alkali producers are uniquely positioned. They already generate hydrogen at scale; the challenge lies in capturing its full value. Advanced oxygen removal and drying technologies offer a clear path forward, one that prioritises recovery, reliability and long-term efficiency over short-term convenience. When purification is designed not merely to meet specifications but to protect hydrogen recovery across the system, it becomes a strategic advantage rather than a necessary expense.

Just as important as the technology itself, is how purification systems are engineered, built and supported. Facilities increasingly benefit from partners that can move quickly between design and fabrication, adapt to evolving project requirements and align closely with existing plant standards. Shorter feedback loops between engineering and manufacturing allow systems to be customised without introducing delays, while vertical integration helps ensure that design intent carries cleanly through fabrication, testing and commissioning.

This approach becomes especially valuable in complex or fast moving projects, where specifications may evolve, tie-in constraints emerge late, or integration details need to be refined in real time. Purification solutions that are developed, fabricated and supported under one roof are often better equipped to respond to these realities, reducing turnaround time, minimising rework and simplifying coordination for plant teams.

For chlor-alkali operations reassessing how they manage hydrogen streams, the opportunity is straightforward but consequential: cleaner gas, higher recovery, faster project execution and a stronger return on energy already invested. In that context, purification is no longer just a unit operation, it becomes an enabling component of a more resilient, efficient production strategy.

For more information:
Visit psbindustries.com

PSB Industries' integrated control panels are engineered to align with plant automation standards

Skid-mounted purification systems combine catalytic oxygen removal and deep drying to maximse hydrogen recovery in chlor-alkali service

Building the future of downstream energy

How TotalEnergies and Saudi Aramco are creating a next generation refining and petrochemicals hub in Jubail

In Saudi Arabia's industrial heartland, TotalEnergies and the Saudi Arabian Oil Company (Saudi Aramco) are advancing one of the world's most ambitious downstream energy projects.

Their joint venture, SATORP, is now the foundation for *Amiral* – an $11 billion (€9.4 billion) petrochemicals complex designed to reshape the region's refining and chemicals landscape and position the Kingdom as a global leader in high value petrochemical production.

A strategic partnership

TotalEnergies' presence in Saudi Arabia dates back to 1974, but its partnership with Saudi Aramco has deepened significantly over the past decade.

The centrepiece of this collaboration is the Saudi Aramco Total Refining and Petrochemical Company (SATORP), a joint venture in which Aramco holds 62.5% and TotalEnergies 37.5%.

Located in Jubail on the Kingdom's east coast, SATORP is already one of the world's most advanced and complex refineries, capable of processing up to 460,000 barrels per day.

This platform has become the launchpad for an even more ambitious undertaking: the *Amiral* petrochemical complex, a huge project designed to integrate seamlessly with the existing refinery and dramatically expand the site's downstream capabilities. Both companies reached their final investment decision in December 2022, marking the beginning of a new phase in Saudi Arabia's industrial diversification strategy.

A world scale petrochemical complex

The project represents a major step forward in the Kingdom's efforts to move further along the hydrocarbon value chain. With a total investment running into billions of dollars, the complex is designed to convert refinery by-products and low cost feedstocks into high value petrochemicals used in everything from packaging and automotive components to specialty chemicals and advanced materials. Key components of the *Amiral* complex include:

- A mixed feed cracker capable of producing 1.65 million tonnes of ethylene per year, using a combination of off gases and naphtha from SATORP, as well as ethane and light naphtha supplied by Saudi Aramco.
- Two polyethylene production lines, each with a capacity of 500,000 tonnes per year, enabling the production of high demand plastics.
- Units for butadiene extraction, aromatics production and other high value derivatives, supporting a broad portfolio of downstream products.
- A dedicated industrial park designed to host specialty chemical manufacturers who will use the cracker's output to produce fibres, lubricants, additives, adhesives and other advanced materials.

Construction began in 2023, with commercial operations scheduled to start next year. Once operational, *Amiral* will significantly expand Saudi Arabia's petrochemical footprint and strengthen its position in global markets.

Why integration matters

One of the defining features of the project is its deep integration with the SATORP refinery. This integration is not merely logistical – it is strategic.

1 **Maximising feedstock efficiency**
By using off gases, naphtha and other by-products from the refinery as feedstock for the cracker, the complex reduces waste and improves overall energy efficiency. This aligns with TotalEnergies' strategy of developing petrochemicals from advantaged feedstocks and leveraging synergies within major integrated platforms.

2 **Enhancing value creation**
Refining alone produces fuels and basic products with relatively low margins. Petrochemicals, by contrast, offer significantly higher value. By integrating the two, SATORP and *Amiral* can capture more value per barrel of crude processed.

3 **Supporting Saudi Arabia's industrial diversification**
The Kingdom's Vision 2030 strategy emphasises expanding downstream industries to reduce reliance on crude exports. The project directly supports this goal by enabling the production of advanced chemicals and polymers domestically.

A platform built for global competitiveness

The SATORP refinery is already recognised as one of the world's most sophisticated facilities, capable of processing heavy crude into high value products such as diesel, jet fuel and petrochemical feedstocks. Its complexity and scale make it a critical supplier to both domestic and international markets. The addition of *Amiral* transforms the site into a fully integrated refining to chemicals platform – a model increasingly favoured by global energy companies seeking resilience in volatile fuel markets.

"With a total investment running into billions of dollars, the complex is designed to convert refinery by products and low cost feedstocks into high value petrochemicals"

Key competitive advantages include:

- Access to low cost feedstocks from Saudi Arabia's vast hydrocarbon resources.
- State of the art processing technologies that maximise efficiency and minimise emissions.
- Proximity to major export markets in Asia and Europe via the nearby Persian Gulf.
- A growing ecosystem of downstream manufacturers attracted by the new specialty chemicals park.

Navigating a challenging geopolitical landscape

While the long term vision for SATORP and *Amiral* is clear, the region has faced significant geopolitical challenges. The SATORP refinery recently sustained damage during the ongoing Middle East conflict, prompting a precautionary shutdown of several units. No casualties were reported, and a full assessment was initiated.

These events underscore the strategic importance of resilient infrastructure and diversified supply chains – factors that both TotalEnergies and Saudi Aramco have emphasised in their long term planning.

Despite these disruptions, the companies remain committed to advancing the *Amiral* project and strengthening the Kingdom's downstream capabilities.

The new complex is expected to generate significant economic benefits for Saudi Arabia and the wider region.

The construction and operation of the complex will create thousands of direct and indirect jobs, supporting local employment and fostering specialised technical expertise.

By expanding petrochemical production, the project contributes to the Kingdom's goal of increasing the share of non oil sectors in its GDP.

The specialty chemicals park is designed to attract global manufacturers seeking reliable feedstock and world class infrastructure.

As demand for petrochemicals continues to grow – particularly in Asia – the integrated SATORP Amiral platform positions Saudi Arabia as a key supplier of essential materials.

A vision for the future

The collaboration between TotalEnergies and Saudi Aramco reflects a broader shift in the global energy landscape. As the world transitions toward lower carbon solutions, petrochemicals remain essential for modern life – from medical equipment and electronics to renewable energy technologies.

By investing in advanced, efficient, and integrated facilities, both companies are positioning themselves for a future in which value creation increasingly comes from materials rather than fuels.

Amiral is more than a petrochemical complex; it is a blueprint for the next generation of downstream energy infrastructure – one that is efficient, resilient, and deeply integrated. ▮

For more information:
Visit Aramco.com and totalenergies.com

Greater control

Why are electric PRVs replacing self-piloting steam regulators?

A trend has been gaining traction. Electric modulating pressure-reducing valves (PRV) are increasingly replacing traditional self-piloted regulators in steam systems.

The adoption of this "smart" technology is part of the overall trend of digitally connecting all components to building automation systems (BAS) for greater visibility and control and for lower energy consumption.

Sometimes the shift to electric PRVs is driven by more basic considerations. For example, PRVs with electric actuators can be more compact, allowing them to fit in spaces too confined to install – and maintain – a pilot-operated steam regulator.

Moreover, an electric PRV can be set up to automatically calculate the downstream steam flow rate, without the need to install a traditional flowmeter. This is an important benefit in locations that lack a sufficient straight run of pipe to accommodate a traditional flowmeter.

Pressure reduction increases efficiency

Steam is usually produced at high pressure by a steam boiler, to avoid the production of wet steam among other reasons and then distributed to one or more points of use that require lower pressure for safe and efficient operation. Steam pressure-reducing stations perform the critical function of reducing the pressure to a desired set point.

The control of pressure can also be an effective means of controlling temperature because the temperature of saturated steam is closely related to its pressure.

A single facility may have several pressure reducing stations. Hospitals, for example, require PRVs to deliver steam for many different uses, including heating, humidification, hot water, sterilisation, kitchen and laundry functions, with varying steam usage requirements based upon the process, the time of day, weather, etc.

Pressure reducing stations also facilitate cost-effective distribution. Significantly smaller pipe diameter can be used where the steam is under high pressure.

Therefore, at sites where the steam plant serves many buildings spread over a large area, the pressure reducing stations may be located close to the points of use to save on the installation cost of piping and fittings.

This benefit needs to be weighed against the energy savings achieved from reducing radiant heat loss when distributing steam at lower temperatures.

The goal is not only to deliver steam below the maximum allowable working pressure (MAWP) of each

piece of equipment, but to maximise energy efficiency for financial saving and environmental sustainability.

The most significant energy savings from pressure reduction comes from delivering the optimal pressure at the point of use.

Lower pressure results in increased enthalpy of steam and the availability of more latent heat. In other words, more BTUs can be delivered per pound of steam when the pressure is reduced.

Traditional pilot-operated regulators

Originally invented in the 1880s, pilot-operated steam regulators are a tried-and-true method of reducing steam pressure and flow.

The main advantage is that they operate as self-contained devices that do not require electrical power or a pneumatic air supply.

The operating principle is relatively straightforward – the valve operates by continuously balancing the downstream pressure (via a pressure-sending pipe) against a mechanical spring that operates in conjunction with a bellows or diaphragm.

The pressure set point is adjusted by tightening or loosening bolts to increase or decrease the spring force.

Pilot-operated PRVs have several disadvantages inherent in their design. They provide a limited turndown ratio, typically 10:1.

Therefore, it is quite common that multiple pilot-operated valves are installed in series, often in a 1/3 2/3 configuration, to produce the net pressure reduction required.

These devices are also prone to failure due to clogging by moisture and dirt in the small-diameter pressure sensing pipe and in the valve itself.

Steam is used both as the sensing mechanism and as the force for moving the diaphragm.

The greatest advantage of pilot-operated valves – operation as a self-contained, isolated device – also serves as an important disadvantage.

The 'set-it-and-forget-it' adjustments provide stable downstream pressure, but the pressure cannot be flexibly modulated based on changing load, weather, and other conditions.

Pilot-operated valves not only lack the ability to be intelligently controlled, but they are also unable to remotely communicate alerts of problem conditions or data on usage.

In fact, a pilot-operated valve provides no visibility of its internal settings and operating condition even when engineers are standing in front of it.

Electric modulating PRVs

Electric modulating PRVs employ an electric actuator to open and close the valve.

Instead of the steam in a pressure-sending pipe used by a pilot-operated system, electronic PRVs utilise electrical signals.

A controller continuously reads the downstream pressure and temperature from a sensor and uses this information to control the valve's electric actuator. Globe valves with electric actuators provide much more precise control than pilot-operated valves.

They have a turndown ratio of 50:1 that supports low loads without the need for 1/3 2/3 configurations.

The systems are more reliable and require less maintenance because the electrical connections eliminate the clogging problems of pilot sensing pipes. Globe valves are also more compact than pilot-operated regulators, making them suitable for confined spaces.

A smarter solution

As a connected system, electric modulating PRVs are fundamentally different from standalone pilot-operated valves. In conjunction with sensors, controllers and building automation systems (BAS), they offer new capabilities of visibility and control.

A globe valve with an electric actuator, such as the Warren Controls ILEA 5800E Series, provides a large turndown ratio and precise modulating control for steam PRV applications

Visibility. The controller has constant visibility of the exact position of the valve. This information is useful in several ways. The pressure reduction station can be monitored remotely, generating alerts of fault conditions.

Steam usage data can be captured. The downstream flow rate can be calculated, using the orifice plate method, without installing a flowmeter.

Control. The PRV can be precisely modulated, and automatically controlled by logic programmed into the local controller or the building automation system to optimise the system for energy efficiency or performance, and in emergencies, the PRVs can be controlled by personnel accessing the BAS remotely.

The ability to remotely monitor and control PRVs is especially useful when pressure-reducing stations are widely distributed at points of use through a large campus or facility and when the steam is used for several different processes.

Bringing steam in line with other systems

As building automation systems become more commonplace, steam pressure-reducing stations are sometimes one of the last components to be integrated, long after chillers and boilers have been connected.

Electric modulating PRVs have proven to be highly reliable and easy to maintain while providing dramatically improved visibility and control that enables significant energy savings.

A site in New England installed a turnkey digital modulating PRV solution engineered by Warren Controls. The facility had a seasonal reduction of steam pressure from 60 PSIG in the fall/winter to 15 PSIG in the spring.

A Warren Controls ILEA Globe Valve with Electric Actuator was installed as a PRV after it was determined that a pilot operated pressure reducing valve would suffer poor downstream pressure control and potentially choke steam flow to the heating hot water set when in the late spring/early summer.

Also, there was insufficient space for a pilot-operated PRV and insufficient straight run to accommodate a traditional flow meter.

For more information:
Visit: warrencontrols.com. This article was written by Robert Workosky from Warren Controls

Dewatering in extreme terrain

Pump company takes swift action after Verdon Gorge in France comes under pressure

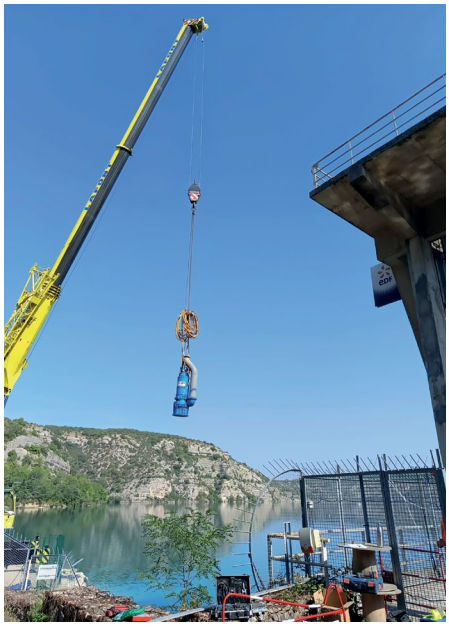
During the construction of a new 250-metre-long bypass road to secure a tunnel in the Gorges du Verdon, 180,000 m^3 of water had to be drained in a controlled manner – under geologically challenging conditions in one of the steepest and deepest limestone gorges in Europe.

Pump manufacturer Tsurumi used a multi-stage high-performance system to reliably ensure water drainage in this extreme terrain.

The Gorges du Verdon is one of Europe's most spectacular natural phenomena: over thousands of years, the Verdon River has carved a spectacular gorge into the limestone massif.

The gorge stretches for around 21 kilometres between its start near Castellane and the Lac de Sainte-Croix reservoir. In some places, the rock faces rise up to 700 metres. This topography makes construction and development work in this region technically challenging when new transport routes such as bypasses or tunnels are planned.

The current construction project, a 250 metre-long bypass road to secure an existing tunnel, initially presented a huge hydrological challenge: 180,000 m^3 of water had to be drained in a controlled manner before rock work could begin. To achieve this, the pump manufacturer Tsurumi installed a high-performance system consisting of pumps from several series via its French subsidiary – a technically sophisticated solution for extreme operating conditions.



A pump being lowered into place. Picture from Tsurumi

Pump expertise

The situation on site was challenging: The pumps were lowered to a depth of 22 metres and the accumulated water had to be drained via a horizontal pipe with a height difference of around 21 metres.

In addition, pipes, electrical connections and settling basins had to be prepared – all under the complex geological and topographical conditions of the Verdon Gorge. Only with careful planning and robust technology was it possible to achieve such water drainage.

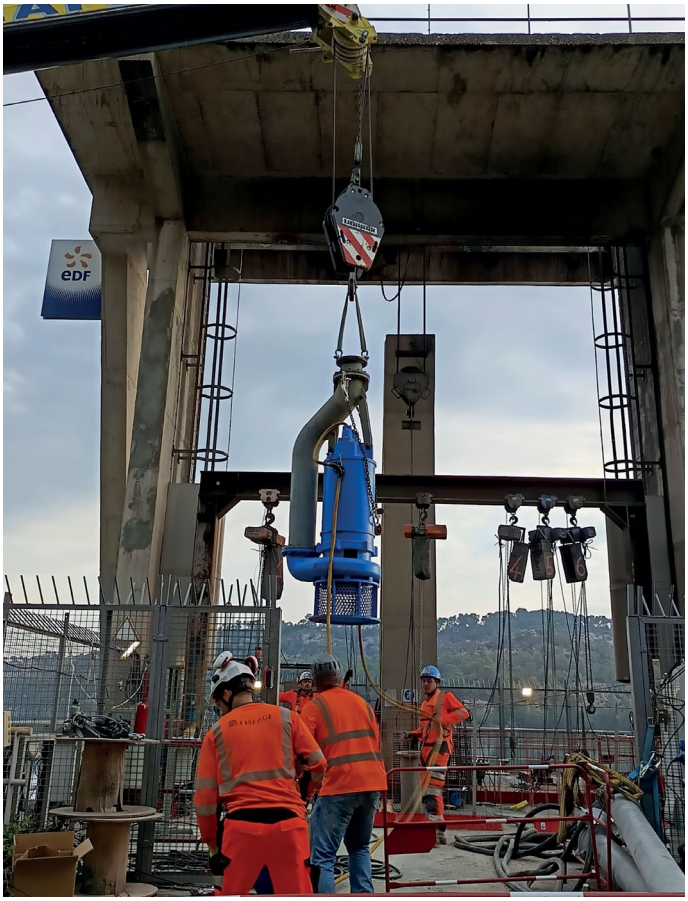
Following this successful execution, the pump system was started up. A combination of one GSZ pump, two KRD pumps and three LH pumps took over the drainage.

The GSZ pump, known for its very high flow rates and robust construction, handled the main volume flow: typical features of this series are flow rates of over 10,000 litres per minute, motor outputs of up to 30 kW, wear-resistant hydraulics and a heavy-duty casing – ideal for large-volume and continuous dewatering, even with abrasive dirty water.

The two KRD pumps provided additional support: thanks to integrated agitators, sediments and deposits could be stirred up and kept transportable

Verdon Gorge in southern France

Tsurumi supplied all the equipment for water logistics. Picture from Tsurumi



Tsurumi supplied all the equipment for water logistics. Picture from Tsurumi

Installation of a pipe extension for a height difference of 21 metres. Picture from Tsurumi

– a great help given the sometimes considerable sludge load in the gorge.

The three LH pumps rounded off the system: their multi-stage design allows high pressures and extreme delivery heads (up to 216 metres for the LH-W series), making them ideal for discharging water over height differences and longer transport distances. The robust solid cast construction of the LH pumps also ensures maximum stability and reliability in difficult environments.

Special pump network

Within just under 43 hours, the pumps had already pumped out 90,000 m^3 of water. The remaining water was then able to drain away by gravity, a result that impressively demonstrated the performance and efficiency of the pump system used. The pumps operated without interruption throughout the entire pumping process, even though the conditions were anything but easy.

Why this particular pump concept? In the Verdon Gorge area, heavy sedimentation, high water volumes and potentially unstable ground conditions pose a considerable technical challenge. Conventional pumps would possibly be overloaded or damaged by abrasive material.

The combination of powerful, wear-resistant GSZ pumps, agitator-assisted KRD pumps for sediment mobilisation and high-pressure LH pumps for overcoming significant differences in height ensured robust, continuous and controlled drainage: an essential prerequisite for carrying out the subsequent tunnel and road construction work safely and efficiently.

In addition, a construction project of this kind in the region poses not only hydraulic, but also geological and topographical challenges. The limestone rock faces steep terrain and large differences in elevation require not only precise planning but also flexible, powerful technology.

The use of Tsurumi pumps in this instance demonstrated how modern pump technology can be crucial in ensuring water logistics under such conditions.

Successful outcome

The construction project ultimately serves to provide sustainable transport access and safety in this sensitive and spectacular landscape. With the successful drainage of the water, the foundation was laid for the rock work to begin.

The use of dirty water pumps has shown that even under extreme conditions, large volumes of water can be managed in a controlled manner – proof of technical excellence and practical engineering.

For construction companies, engineering firms or civil engineering projects operating in challenging terrain such as gorges, mountains or narrow valleys, this example provides a clear indication: with the right pump technology and support from the manufacturer, even large-scale dewatering projects in complex infrastructure projects can be managed on schedule. ▮

For more information:
Visit tsurumi.co.uk

"The situation on site was challenging: The pumps were lowered to a depth of 22 metres and the accumulated water had to be drained via a horizontal pipe with a height difference of around 21 metres"

Reaching goals

Vaisala refractometers enable development of advanced 'green hydrogen' electrolysers

The generation of green hydrogen by water electrolysis represents an exciting decarbonisation opportunity.

However, the performance of electrolysers is heavily impacted by the characteristics and stability of the electrolyser's components. A group of engineers in Germany is now developing a test bench for alkaline electrolysis.

A key factor affecting the success of this project is the ability to accurately and reliably monitor electrolytes in an extremely aggressive solution. Following a global search for suitable technologies, the researchers found that Vaisala's inline refractometers were able to meet their stringent requirements.

The project partners are the engineering services provider iChemAnalytics, the electroplating technology specialist Dr Max Schlötter and the coating expert WHW Hillebrand.

Background

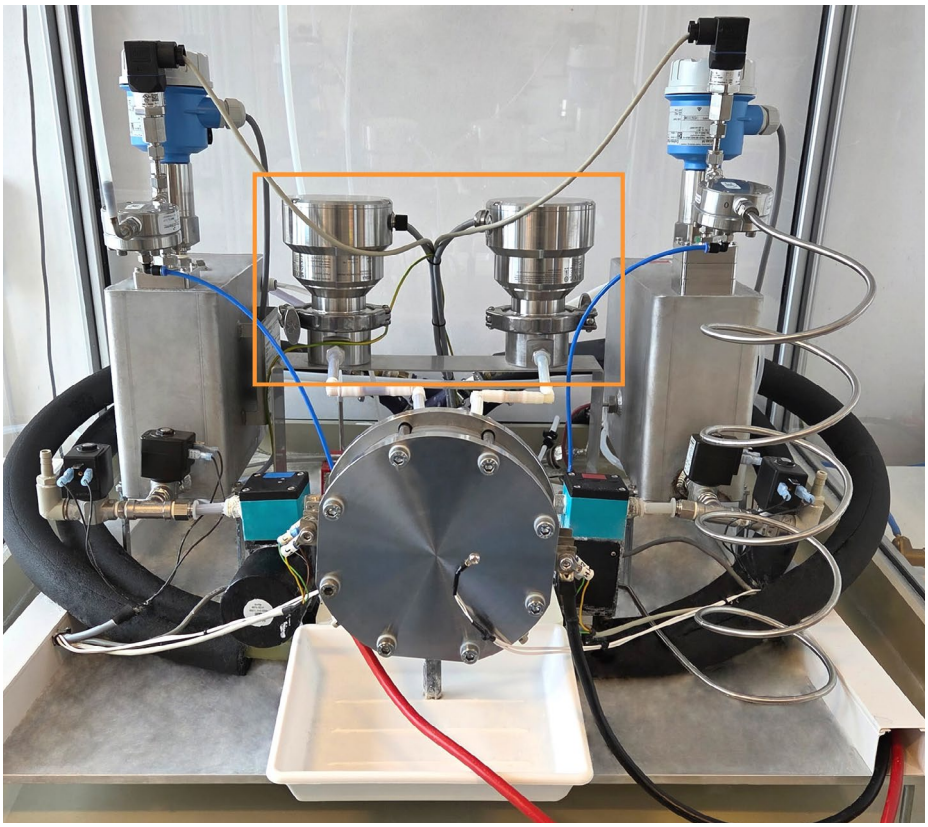
Hydrogen represents an exciting opportunity as the world seeks to decarbonise its energy infrastructure in the pursuit of a net-zero goal.

This is because hydrogen has a high calorific value and its combustion products do not contain any greenhouse gases that are considered major contributors to global warming.

However, hydrogen is currently mostly produced from fossil fuel-intensive processes, generating 'grey hydrogen' which globally accounts for around 2% of carbon emissions.

Where hydrogen is generated from the electrolysis of water, powered by renewable energy, the resulting 'green hydrogen' offers a significant opportunity for decarbonisation, so there is a high level of interest in efficient, sustainable electrolysers.

Alkaline hydrogen electrolysers use an electric current to split water into hydrogen and oxygen using a liquid alkaline solution such as potassium hydroxide (KOH) as the electrolyte.



Electrolyser KOH Refractometers is highlighted

Typically, the solution is 15 to 30% KOH, which is very aggressive. The electrolyte is contained between two electrodes, typically nickel-based, separated by a porous diaphragm or membrane.

Hydrogen gas is produced at the cathode and oxygen gas is produced at the anode. The diaphragm separates the gases and transports hydroxide ions from the cathode to the anode to complete the circuit.

The main objectives were:

1. Create a working, fully automated test bench for electrolyser stacks;
2. Develop a new electrode coating which is stable for over 80,000 hours;
3. Evaluate prototype coatings over a range of different working conditions.

Why measure electrolyte strength?

Each side of the membrane in the test bench electrolyser contains a 30% KOH solution – a highly concentrated, strong and corrosive alkaline liquid that is 30% potassium hydroxide and 70% water by weight. During electrolysis the ratio of KOH % on either side of the membrane changes. This is important for multiple reasons. The service life of the components and the phase boundary reactions within the cells change negatively, which also has a direct influence on cell voltage, ageing effects and reaction efficiency.

Electrolyte measurement technology

The project team conducted a worldwide search for a technology that would be able to operate in such a challenging environment, delivering accurate and

reliable KOH measurements. The ability to operate in 30% KOH at temperatures up to 80°C and pressures up to 5 bar (mounted in-line) ruled out most of the options, leaving either manual laboratory analysis or a small number of technologies based on refractometry or ultrasonics.

Explaining the decision to use Vaisala's inline refractometers, Kristian Macke COO at iChemAnalytics said: "Laboratory analysis was ruled out immediately because of the time taken to derive results, which would render process control and therefore efficiency, impossible to achieve." The project team, therefore, evaluated the continuous measurement options. "We were particularly impressed by the support from Vaisala's distributor, Bühler Technologies," Kristian explained. "They lent us a Vaisala refractometer for a short period so that we could conduct a quick test in our laboratory. They provided CAD files to help integrate the Vaisala device into our test bench, and they provided written confirmation that the refractometer is resistant to KOH permanently."

Two Vaisala PR53AC inline refractometers have been installed on the test bench, providing real-time KOH concentration measurements on both sides of the membrane.

"Hydrogen is currently mostly produced from fossil-fuel intensive processes, generating 'grey hydrogen' which globally accounts for around 2% of carbon emissions"

Kristian says: "This was a significant investment for us, but we have been absolutely delighted with the performance of the Vaisala probes. They were delivered factory-calibrated and were almost plug-and-play. All we had to do was integrate their 4-20 mA output with our PLC."

Vaisala's refractometers measure the angle of refraction of light in the process medium, using an LED light source. A sensor continually detects the critical angle at which the total reflection of light commences, and this has a direct relationship with KOH concentration.

Vaisala refractometry is widely used in demanding industrial processes – from chemicals and pulp & paper to food and pharmaceuticals – where accuracy, chemical resistance and uptime are critical.

In addition to their ability to operate in harsh conditions, one of the main advantages of Vaisala's refractometers is that they are not affected by suspended particles, bubbles or colour, and with the option of automatic prism wash with steam or high-pressure hot water, they are not affected by scaling or fouling.

Project progress

The development of a reliable test bench has allowed the project team to focus on the main objectives. Different electrode coatings and electrolyte solutions are undergoing accelerated stress testing in a range of temperatures, and Kristian said: "The results of a four-week trial were recently published at a conference in Berlin (ZVO Oberflächentage 2025), where we demonstrated extremely good performance data for a new coating."

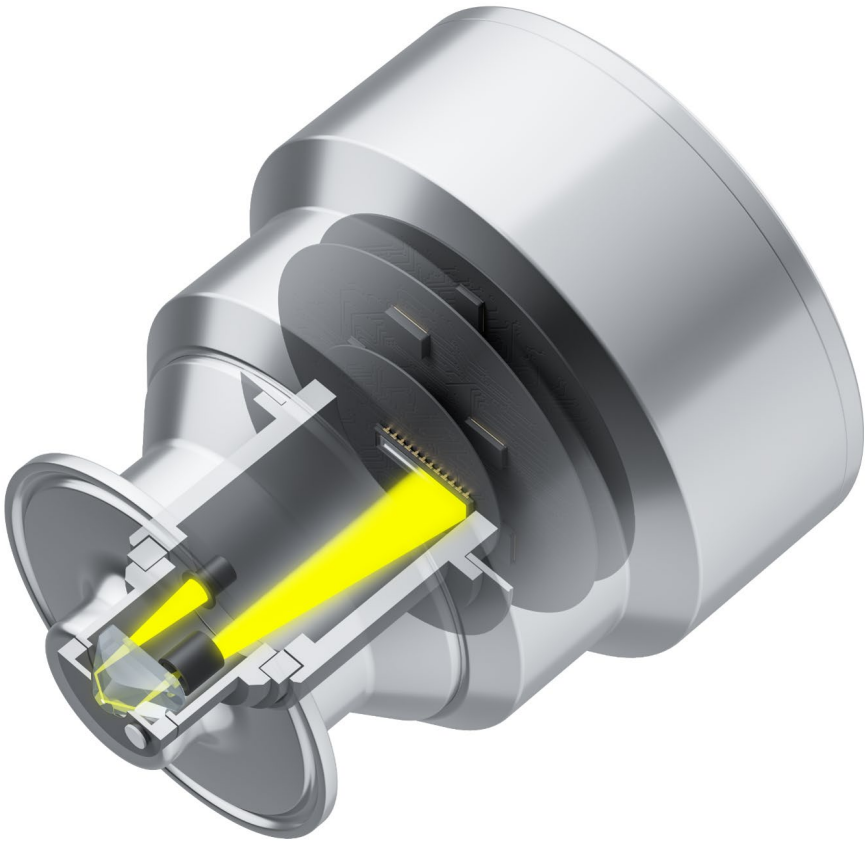
Looking forward

As more sustainable coatings are being developed, the new fully automated test bench will allow the team to optimise electrolysis equipment, materials and conditions in the pursuit of process efficiency.

"KOH concentration measurement with Vaisala refractometers is performing a critically important role in the test bench," Kristian added.

"Clearly, the ultimate goal is to develop new high-performance electrolyser stacks with high-performance surface coatings, and the ability to automatically monitor and control the KOH ratio will be essential for optimising electrolyser components and efficiency."

This project showcases how advanced measurement technology supports innovation in clean energy and accelerates the transition toward low-carbon solutions. ▮



Vaisala Polaris PR53AC core optics

For more information:
Visit vaisala.com

Pressure transmitter installed at downstream choke valve facility

Having a choke-hold

Reliable CO_2 injection choke valves for carbon capture and storage applications

Carbon capture and storage (CCS) has emerged as a critical pathway for reducing greenhouse gas emissions, particularly in hard-to-abate industries such as power generation, cement and steel.

At the heart of any CCS infrastructure is the ability to safely and reliably transport and inject captured carbon dioxide into geological formations for long-term storage.

While much attention is given to capture technologies and storage reservoirs, one component often overlooked, but absolutely essential, is the choke valve used for CO_2 injection.

Why choke valves matter in CCS

Choke valves regulate the flow and pressure of CO_2 as it transitions from surface facilities into subsurface reservoirs.

In CCS applications, the injected CO_2 is often in a supercritical or dense phase, presenting unique challenges compared to conventional oil and gas services. The choke valve must maintain precise flow control under varying operating conditions, manage erosive and corrosive environments and ensure long-term sealing performance to prevent leakage.

Failure of this critical component can compromise safety, jeopardise injection operations and erode public trust in CCS projects.

Technical challenges in CO_2 injection

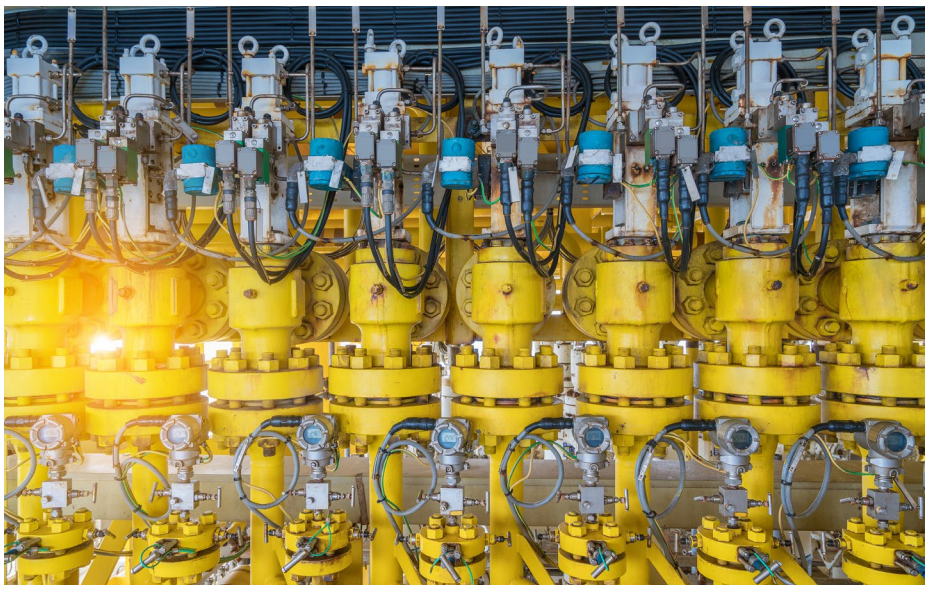
Phase behavior and thermodynamics: CO_2 near the critical point (31.1°C, 7.38 MPa) exhibits highly variable density and compressibility.

As it passes through the choke, pressure drops can induce rapid phase changes, causing flashing, cavitation and Joule-Thomson cooling. These phenomena can damage valve internals if not properly managed.

Corrosion and material selection: CO_2 in the presence of even small amounts of water forms carbonic acid, which can aggressively attack carbon steels. Valves for CCS duty must, therefore, employ corrosion-resistant alloys or protective coatings to ensure reliability.

Erosion from impurities: Depending on the capture process, injected CO_2 may contain impurities such as SOx, NOx, H2S, or particulates. These contaminants exacerbate erosion

"While much attention is given to capture technologies and storage reservoirs, one component often overlooked – but absolutely essential – is the choke valve used for CO_2 injection"



Hydraulic choke valves to monitor downstream pressure

and corrosion risks, demanding robust trim designs and material choices.

Pressure and flow variability: Injection rates often fluctuate with wellbore pressure, reservoir acceptance and surface process conditions. Choke valves must maintain stable performance across wide operating envelopes, resisting vibration, noise and flow-induced instabilities.

Key features of reliable CO_2 injection choke valves

1. **Specialised trim designs:** To handle high pressure drops and avoid cavitation damage, CO_2 choke valves often utilise multi-stage trims. These designs dissipate energy gradually, minimising flashing and reducing noise and vibration.
2. **Advanced materials:** Corrosion-resistant alloys (CRA) such as Inconel, Hastelloy, or duplex stainless steels are commonly employed. For extreme service, tungsten carbide or ceramic trims can provide exceptional erosion resistance.
3. **Metal-to-metal sealing:** Given the long service life expected in CCS projects, reliable sealing is critical. Metal-to-metal seats ensure durability under high differential pressures and reduce leakage risks compared to soft-seated designs.
4. **Anti-icing provisions:** Rapid gas expansion through the choke can cause CO_2 to cool dramatically, leading to ice or hydrate formation. Some valve designs incorporate heating elements, insulation, or special trims to mitigate this risk.
5. **Automation and remote monitoring:** Modern CCS projects require integration with digital control systems. Reliable choke valves support smart actuators, positioners and sensors that enable precise remote control and continuous monitoring of valve health.

Field-proven reliability

Several manufacturers have adapted oil and gas choke valve technologies for CCS duty, drawing on decades of experience with sour gas and high-pressure injection services.

Field data demonstrates that properly designed CO_2 these valves can operate reliably for years, provided that operators adhere to rigorous maintenance schedules and material specifications.

Pilot CCS projects across Europe, North America and Asia have validated the importance of choke valves in maintaining injection performance. In some cases, operators reported reduced downtime and extended service life after transitioning from conventional oilfield valves to purpose-built CCS choke designs.

Future directions

As CCS projects scale from pilot to gigaton levels, demand for robust solutions will only grow. Future innovation will likely focus on:

- Improved digital integration, including predictive maintenance through AI and IoT platforms;
- Modular valve designs for easier replacement and upgrades in remote sites;
- Enhanced testing standards, ensuring valves meet CCS-specific requirements beyond conventional hydrocarbon service;
- Lower total cost of ownership, as economies of scale and manufacturing advances reduce upfront costs while maintaining long-term performance.

Conclusion

The success of CCS as a large-scale climate mitigation strategy depends not only on capturing and storing CO_2, but also on ensuring every link in the chain performs reliably.

Choke valves may seem like a small piece of the puzzle, but their role in regulating CO_2 injection makes them indispensable.

By deploying choke valves designed specifically for CO_2 service – equipped with advanced materials, specialised trims and digital monitoring – operators can ensure safe, efficient and long-term storage of carbon dioxide.

In a sector where reliability directly translates into public trust and climate impact, the humble choke valve proves to be a critical enabler of our low-carbon future. ▮

For more information:
Visit ccsassociation.org

A gas transmission pipeline

Flagship chemical industry showcase returns

The CHEMUK 2026 Expo will once again bring the entire UK chemical, process engineering and formulated products sectors together under one roof at the NEC Birmingham on 20-21 May

With more than 600 specialist exhibitors expected and a growing reputation for delivering high value networking, innovation and technical insight, the event is set to be as popular as ever.

The two-day event has rapidly established itself as the UK's largest and most comprehensive annual event for the chemical supply chain, chemical processing and product formulation sectors. Its continued growth reflects the industry's appetite for a single, integrated platform where manufacturers, suppliers, engineers, scientists and regulatory specialists can meet, collaborate and explore new technologies.

According to the NEC, CHEMUK has become a "vital annual touchpoint" for the sector, offering a rare opportunity for stakeholders to connect across the full ecosystem.

The 2026 edition will once again occupy Hall 5 of the NEC Birmingham and will feature an expanded show layout divided into five specialist zones:

- **Process & Chemical Engineering Zone**
- **Chemical Laboratory Zone**
- **Chemicals Supply Zone**
- **Chemicals Management Zone**
- **Formulated Product Manufacturer Zone**, a relatively new addition introduced last year.

With more than 100 expert-led sessions scheduled, attendees can expect a strong programme of technical talks, regulatory updates, case studies and panel discussions. These sessions are designed to support knowledge exchange and help organisations navigate challenges such as sustainability, digitalisation, safety, compliance and supply chain resilience.

A major platform for pump and valve technologies

For the fluid handling community, CHEMUK has become an increasingly important showcase. The event attracts a wide range of pump, valve, sealing and flow control specialists serving chemical production, petrochemicals, pharmaceuticals, water treatment, food and beverage and other process industries.

Among the confirmed exhibitors is AxFlow, a leading supplier of pumps, valves, mixers, heat exchangers and engineered fluid handling systems. Exhibiting at Stand K10, AxFlow will highlight its corrosion resistant solutions, precision process control technologies and engineered systems designed to support safe, efficient and reliable chemical production. The company's portfolio spans mixing and agitation equipment, pumps and valves tailored for both continuous and batch operations.

The show's Process & Chemical Engineering Zone historically attracts a strong line up of pump and valve manufacturers, distributors and engineering specialists. Visitors can expect representation from companies involved in:

- **Positive displacement pumps** including progressive cavity, rotary lobe, peristaltic, screw pumps
- **Centrifugal pumps** for chemical transfer, dosing and circulation
- **High performance valves** for corrosive, abrasive and high temperature media
- **Sealing and gasket technologies**
- **Instrumentation and flow control systems**

Some of the highlights from last year's show

CHEMUK's broad cross sector appeal means pump and valve suppliers benefit from exposure to both traditional chemical producers and fast growing segments such as battery materials, hydrogen, speciality chemicals, biotech and formulated consumer products.

Why CHEMUK matters in 2026

The chemical industry continues to face a period of rapid transformation driven by regulatory change, sustainability pressures, digitalisation and the need for more resilient supply chains. The 2026 edition of the event arrives at a pivotal moment, offering a platform where companies can benchmark solutions, explore new technologies and engage with peers facing similar challenges.

Key themes expected to dominate include:

1 **Sustainability and decarbonisation**
From low carbon feedstocks to energy efficient process equipment, exhibitors will showcase technologies that help reduce emissions, improve resource efficiency and support circular economy models.

2 **Process optimisation and digitalisation**
Advances in automation, data analytics, predictive maintenance and smart instrumentation will be central to many stands and conference sessions. For pump and valve suppliers, this includes intelligent monitoring systems, digital twins and condition based maintenance tools.

3 **Safety, compliance and risk management**
With evolving UK and EU regulatory frameworks, CHEMUK provides a valuable forum for updates on chemical safety, REACH, CLP, process safety and environmental compliance.

4 **Innovation in formulated products**
The expanded Formulated Product Manufacturer Zone reflects growing demand for innovation in coatings, adhesives, personal care, cleaning products and speciality formulations.

A uniquely comprehensive event

One of CHEMUK's greatest strengths is its ability to bring together the entire chemical value chain. Visitors range from R&D chemists and plant engineers to procurement teams, operations managers, regulatory specialists and senior executives. This diversity creates a dynamic environment where cross disciplinary conversations can spark new ideas and partnerships.

The show's structure, combining exhibition zones with a multi track conference, allows attendees to tailor their visit to their specific interests, whether that's laboratory innovation, process engineering, supply chain management or product formulation.

As the countdown to CHEMUK 2026 continues, anticipation is building across the UK chemical and process industries. With more than 600 exhibitors expected, a strong technical programme and a growing international profile, the event is set to deliver significant value for visitors and exhibitors alike.

For pump and valve professionals, CHEMUK remains an essential date in the calendar, offering a chance to explore the latest technologies, meet suppliers, compare solutions and gain insights into the future of fluid handling in the chemical sector.

For more details:
Visit chemicalukexpo.com

The two-day event has rapidly established itself as the UK's largest and most comprehensive annual event for the chemical supply chain, chemical processing and product formulation sectors

SAVE THE DATE!

CHEMUK2027

19th & 20th May 2027, Hall 5, The NEC, Birmingham, UK

CHEMICALS SUPPLY ZONE

CHEMICALS MANAGEMENT ZONE

PROCESS & CHEMICAL ENGINEERING ZONE

CHEMICAL LABORATORY ZONE

FORMULATED PRODUCT MANUFACTURER ZONE

Supporting the Chemicals, Process Engineering, and Formulated Product Industries

1
Expo

5
Show Zones

600+
Exhibitors

150
Speakers & Panels

Supporting Partners include:

ROYAL SOCIETY OF CHEMISTRY · BCA British Chemicals Association · BCMPA · IChemE · Chemicals northwest · cia CHEMICAL INDUSTRIES ASSOCIATION · Chemical Business Association · BASA BRITISH ADHESIVES & SEALANTS ASSOCIATION

FIND OUT MORE AT WWW.CHEMICALUKEXPO.COM