Issue 19

innovations

in automation

Software and technology to help meet your sustainability goals

Emerson helping Albioma become a fully **renewable energy provider**

French independent energy provider Albioma has selected Emerson to help transition its coal-fired Bois Rouge plant on Réunion Island in the Indian Ocean to 100% renewable energy. As part of Albioma's wider mission to transition all of its existing fossil fuel plants to renewable energy, Emerson's automation systems and software will enable the coal-fired power station to convert to biomass feedstock.

The multi-million-dollar project is an example of how Emerson technologies are helping customers accelerate their transition to more sustainable energy. The power plant, one of three that Albioma operates on the island, will be converted to use 100% biomass wood pellets. The overhaul of the 108-megawatt facility will reduce greenhouse gas emissions by approximately 640,000 tons of CO_2 equivalent per year, an 84% decrease in direct emissions compared to current operating levels.

"Emerson is an automation partner with whom we have a trusted relationship and whose extensive experience and expertise in biomass power plants will be crucial to this project being completed on schedule," said Pascal Langeron, Albioma's chief operating officer for Réunion Island.

The plant consists of three generating units. Two are already controlled by Emerson's **Ovation™** distributed control system, which will be modified for use with biomass feedstock, and the third will be replaced with a new Ovation system. The units will also be modernised with new turbine protection and health monitoring systems, safety systems for the boilers, and upgraded boiler control elements and instrumentation.

To ensure the project is completed within the available timeframe – a critical requirement of Albioma – Emerson will provide its **Project Certainty** methodologies, digital technologies and software expertise. In addition to delivering local engineering support for the project, Emerson will provide its **Remote Virtual Office (RVO)** collaboration platform – a secure virtual engineering and testing environment that will enable Albioma to access Emerson's resources and ongoing support to reduce project risk and costs.

To discover how Emerson's biomass power plant controls can ensure efficient and reliable operation, visit Emrsn.co/IM1902

Digital solutions and expertise support **Toyota in sustainable fuel generation**

Emerson has collaborated with Toyota Australia to transform part of its operations into a commercial-grade hydrogen production, storage and refuelling plant. The project, supported by the Australian Renewable Energy Agency, adopts Emerson's automation expertise to provide the control system that helps Toyota Australia demonstrate the technical and economic feasibility of manufacturing hydrogen fuels.

As low- and zero-emissions vehicles capture a greater share of the market, countries around the world need to expand access to renewable fuels like hydrogen. However, sustainable hydrogen projects are challenging because they need to integrate many data sources into one balance-of-plant system. For the Toyota Australia Hydrogen Centre, Emerson's advanced **DeltaV™ distributed control system** gathers data from the plant's complex equipment, making it easier to monitor production and storage of hydrogen gas, and document and validate the sustainability of operations.

By incorporating a digital automation foundation to eliminate data silos, Toyota Australia can not only significantly reduce costs, but also gain greater visibility into system performance, making it easier to maintain and report sustainability performance and increase productivity.

Emerson's DeltaV systems control operations for optimal production efficiencies and help ensure safe operations. Edge control technology from Emerson's **PACSystems™** will further reduce the cost and complexity of integrating third-party systems, whilst **Rosemount™ flame detectors** will help keep personnel and operations safe. In addition, Emerson's technologies create a platform to add future remote operations and data analytics more easily and cost-effectively.

Emerson offers automation solutions to help customers across the hydrogen value chain. Find out more: Emrsn.co/IM1903

Welcome to **innovations**

Providing cutting-edge solutions to help create a more environmentally responsible planet is fundamental to Emerson's company purpose: driving innovation that makes the world healthier, safer, smarter and more sustainable. Emerson technologies, software and services are supporting process and manufacturing organisations around the world in their decarbonisation and environmental sustainability efforts. We are also sharply focused on reducing the environmental impact of our own operations, and have announced bold plans to achieve net-zero greenhouse gas (GHG) Scope 1 and Scope 2 emissions by 2030, and net-zero Scope 3 emissions by 2045.

In Issue 17 of Innovations in Automation, we highlighted some of the many ways in which Emerson solutions enable companies to minimise waste and GHG emissions, optimise energy efficiency and achieve environmental sustainability targets. Such is the critical importance of this era-defining topic, and we are devoting this issue to examining further ways in which our wide-ranging capabilities are paving the way toward a more sustainable future.

The rapid expansion of hydrogen fuel cell technology is playing an important role in making road transport more sustainable, and we describe how Emerson's advanced automation solutions are supporting safe and reliable hydrogen fuel dispensing operations. Continuing the transport theme, we look at how the growth of lithium-ion battery technology has been central to the development of electric vehicles and explain how Emerson products and services improve quality and safety in battery component manufacturing.

Heavy industry is increasing its investment in carbon capture, utilisation and storage (CCUS) as a means of reducing CO_2 emissions, and we examine some of the many Emerson technologies that support the safe and reliable operation of the latest CCUS projects. Power generation from wind turbines also continues to grow, and we reveal how retrofitting with modern control technologies and software enables wind farm operators to unlock vital production and maintenance data, enhance the performance of their turbines and extend their lifespan.

Stringent GHG emissions reduction targets have prompted many refiners to invest in processing bio-based feedstocks to produce clean fuels. We describe how Emerson's intelligent field devices and advanced control technologies help them accelerate the transition to biofuels production. Finally, we look at how new plastics recycling plants are embracing the concept of being 'born digital' – implementing advanced automation technologies during the construction phase to help achieve long-term operational excellence.

To discuss how Emerson can help you achieve your environmental sustainability targets, please contact us today via **Emerson.com/ContactUs**

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Previous editions of Innovations In Automation are available at: Emrsn.co/IM1901

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Plastics recycling plants **are 'born digital'**

Julian Annison, digital transformation director, describes how implementing advanced automation technologies right from the construction phase is enabling innovative plastics recycling plants to maximise operational efficiency and performance.

Constructing a new production plant creates an opportunity for it to be 'born digital' and immediately benefit from the implementation of advanced automation technologies. Whereas historically, automation was focused on ensuring production meets required specifications and the plant operates safely, there is now much greater emphasis on implementing technologies that support long-term operational excellence.

There are some obvious drivers for this change. Global competition has placed greater emphasis on plant efficiency, availability and throughput. There are also new societal drivers, such as rising energy costs and the need to reduce emissions and increase sustainability. During the plant design phase, plant operators are now increasingly looking to specify advanced digital technologies that can help meet these challenges.

There is also much greater emphasis on digital automation solutions that future-proof the plant. Forward-thinking companies are putting in place infrastructures – such as wireless networks, data management systems and asset management solutions – that create opportunities to implement future applications that will produce longer-term benefits. Organisations are also considering the need for scalable solutions that are easily replicable to support multiple plants.

Next-generation architecture

Traditionally, automation architectures have been purpose-built with operational data isolated in hardware and software systems. This siloed approach presents a barrier to meaningful data use because separate layers of automation – including sensors and software, cloud-based applications and artificial intelligence – block data access from one layer to the next. By adopting next-generation architectures this empowers companies through 'boundless automation' to manage, connect and deliver operational technology (OT) and information technology (IT) data seamlessly and securely across the enterprise, enabling operational and business performance optimisation.

Plant-wide digital ecosystems incorporating modern control systems and intelligent field devices are now capable of seamlessly integrating on-premise and cloud applications. These feature controllers with integrated device communications, virtualisation and edge computing, and instrumentation with advanced embedded functionality, such as online meter calibration and verification.

Improved plant performance

Being 'born digital' enables the immediate adoption of operational performance technologies such as embedded advanced process control, state-based control and automated loop tuning, that help to automate unit operator functions. Other technologies include data analytics with machine learning and AI to support process performance improvements, loop performance monitoring, root cause failure analysis and predictive analytics. **Pervasive sensing** solutions, incorporating existing measurement technologies and newly developed sensors, offer cost-effective and non-intrusive methods of measuring process and asset variables to provide greater insight. Scalable analytics tools then make sense of data and generate insights that drive more effective decisions about assets and processes.

Empowering a digitally native workforce is an important consideration, with operating and maintenance teams needing immediate access to useful information to support field work. Providing workers with field connectivity and purpose-built mobile devices enables enhanced productivity. Augmented reality applications with superimposed asset and process data enable smarter and faster decision-making, troubleshooting and maintenance.

Enhanced safety and reliability

Improved asset reliability can be achieved through online equipment health monitoring, self-diagnosing instrumentation, abnormal situation awareness and equipment performance analytics. **Secure remote access** enables greater collaboration, with experts both internally and externally able to view process and equipment data to support troubleshooting and predictive maintenance. Being 'born digital' also allows a plant to be designed for **worker safety**, utilising technologies such as muster and geofence monitoring, on-person wireless sensing, location monitoring and gas sensing. Other technologies include automated safety and alarm functions, and functionality such as partial stroke testing to ensure safety valves will operate when required, automated SIF testing and alarm flood management to prevent operators missing critical situations.

Plastics recycling 'born digital'

One industry embracing the opportunity to be 'born digital' is plastics recycling. Currently, many post-consumer plastics, including packaging items such as films, pots and trays, are considered 'unrecyclable' via traditional methods and are sent to landfill or incinerated. New recycling technologies and processes allow plastics, including single use packaging, to have a second life. After successful pilot projects, large-scale recycling plants are now being built with the 'born digital' ethos at their heart.

One example is PureCycle Technologies, which is constructing a network of global facilities to enable large-scale recycling of polypropylene. More than 170 billion tonnes of this plastic are produced each year but less than 1% is reclaimed for recycling and reuse. Emerson will provide advanced digital technologies and automation, with its Plantweb™ digital ecosystem chosen for the breadth of digital solutions, including intelligent sensors and control valves, advanced operations software and systems, cloud data management and analytics.

"Unlike traditional manufacturing facilities coping with transforming legacy platforms to digital, PureCycle's progressive approach will enable all future facilities to be 'born digital'," said Dustin Olson, chief manufacturing officer of PureCycle Technologies. "With Emerson's help, each PureCycle facility is expected to start up with the most advanced digital automation technologies available, allowing for faster project completion, fully integrated systems, and world-class operating performance."

Another advanced recycling company, ReNew ELP, has selected Emerson to provide digital automation for its new plastics recycling plant in Teesside, north-east England. The plant's advanced recycling process uses high pressure and temperature steam to convert waste plastics into chemicals and oils that can be used to manufacture new plastics and other materials. Emerson is providing an integrated control and safety system for process and emergency shutdown, plus fire and gas detection. Emerson's Plantweb digital ecosystem, incorporating wired and wireless networks that support clusters of advanced measurement instrumentation, will provide visibility to process performance and actionable equipment health data. A range of asset management solutions will also be deployed to enhance equipment reliability and increase availability and throughput.

To discover how Emerson's digital solutions can support operational excellence, visit Emrsn.co/IM1904

Advanced control solutions are key to optimising **wind farm performance**

Thomas Andersen, vice-president of renewable energy technologies, explains how retrofitting modern control technologies and software enables wind turbine operators to unlock vital production and maintenance data, maximise the efficiency of their assets and extend their lifespan.

It is expected that by 2040, around 40% of the world's energy consumption will come from renewable sources. To achieve this target, energy producers will not only need to invest in new assets to generate power from sources such as wind, solar, hydrogen, geothermal and biomass, but also extend the lifespan and maximise the efficiency and performance of their existing assets. However, a major challenge facing the operators of wind turbines is a lack of visibility into the status and output of their assets.

Wind farms typically contain numerous turbines provided by multiple original equipment manufacturers (OEMs), and most of these turbines are still operating with 'black box' control or software systems. There is always a trade-off between the amount of power produced by a turbine and how much component wear this will cause, and 'black box' controls are typically set up to enable operators to achieve certain pre-set goals relating to asset performance and lifespan. Unfortunately, OEMs do not provide operators with access to detailed turbine performance and health data, or allow them to make control modifications that can lead to performance optimisation.

This challenge can be met by retrofitting advanced control technologies and software that will enable operators to unlock vital production and maintenance data, enhance the performance of their turbines and extend their lifespan. These latest solutions provide the flexibility to adjust parameters and employ control strategies that will find an operational 'sweet spot' that optimises the balance between power generation and turbine wear. These control strategies can also be used to take advantage of times when the price paid for energy peaks, with production increasing during these periods because it would still make economic sense despite the increased wear on the turbine.

Acquisition of Mita-Teknik

Emerson has a wealth of experience in providing control systems and software for conventional power generation, but is now also very much focused on supporting its customers in transitioning to more renewable energy sources. Through its 2021 acquisition of Mita-Teknik – a leader in the control automation business for wind power generation – Emerson significantly expanded its global reach in renewable energy. It can now provide its customers with a broad, comprehensive portfolio of solutions for retrofitting and modernising wind power controls.

These solutions include plant, turbine and pitch control systems with a full suite of condition monitoring, SCADA systems and asset management software to help determine asset health and optimise performance, regardless of turbine type. Implementing these solutions provides operators with clear insight into their operations – from individual turbines to a full wind farm or even a fleet of wind farms – and the freedom to maintain and operate these assets independently, without having to rely on OEMs.

Replacing a legacy control system with Emerson's retrofitted, smarter control system and advanced software that works with 750 different turbine types enables operators to implement control strategies that will extend the life of their turbines and optimise their performance. This solution makes it possible to increase a turbine's annual production by 3-5%, which conservatively equates to an increase in revenue of €11,000 to €17,000 a year for a 1.5 MW turbine. In addition, improved control strategies enable the lifespan of each turbine to be extended by as much as six years, thereby significantly increasing their earning potential.

Condition monitoring

Because most wind farms are comprised of multiple turbine types from different OEMs, the condition monitoring software implemented by operators must be adaptable. The use of high-performance, vendor-independent software that embraces open standards and protocols enables connectivity to a wide range of devices, thereby streamlining operations and reducing costs.

The latest condition monitoring software includes vibration analysis capability and enables operators to quickly detect existing and emerging faults earlier in the failure curve. Instead of reacting to the consequences of an accelerating issue, operators can proactively apply predictive maintenance strategies to extend the life of their wind turbines.

SCADA solutions

As a natural extension of condition monitoring, a common SCADA system applied across a wide variety of turbine models and control platforms will provide a clear visual indication of turbine health. An intuitive dashboard displaying key production, availability, alarm and weather information enables operators to quickly identify and respond to issues, leading to fewer unplanned outages.

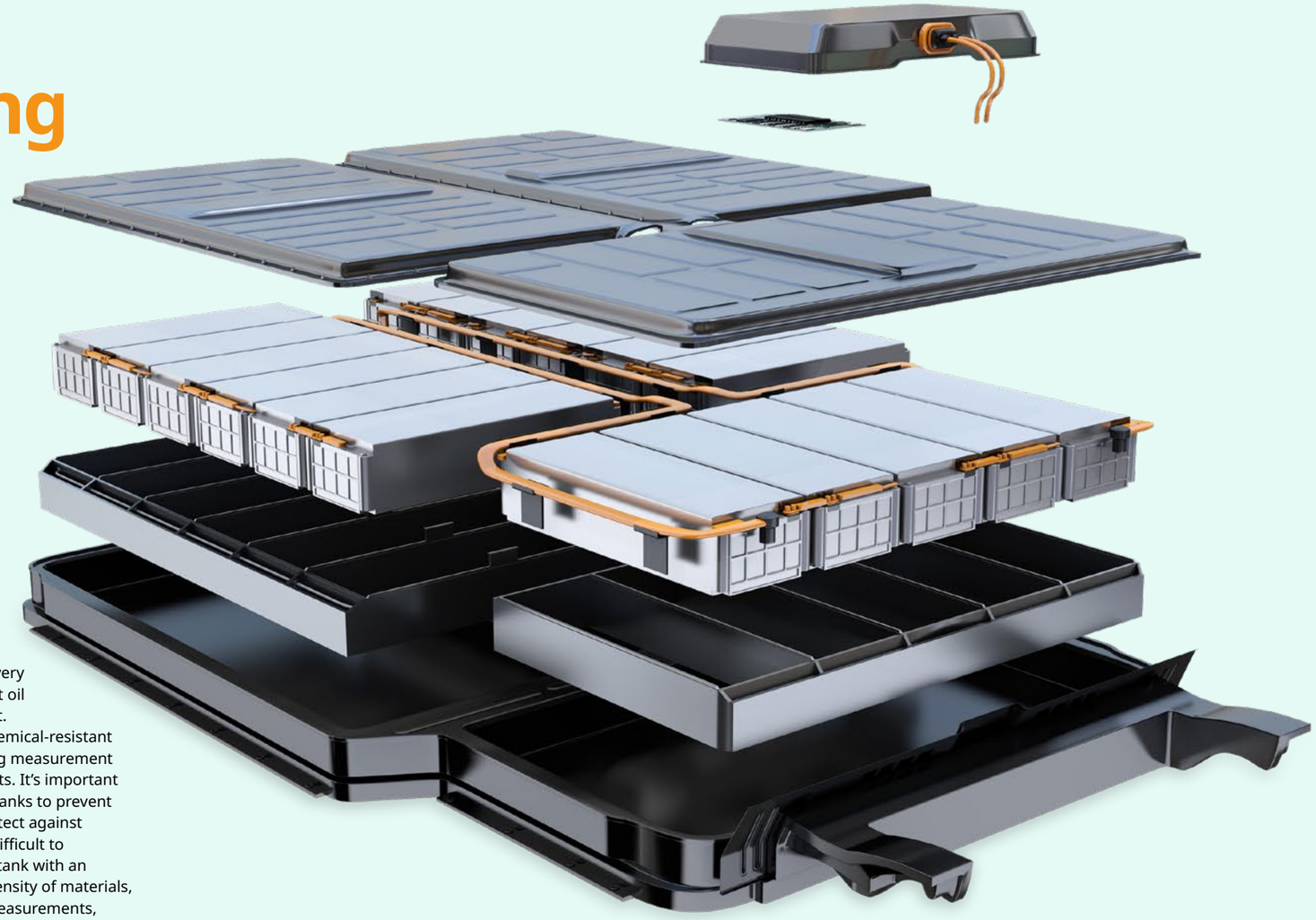
The ability to access, manage and analyse this data becomes even more important for operators choosing to hybridise their energy farms with a mix of power generation sources to optimise their energy output, as they need to know, in detail, what is going on with each asset in real-time. Each of these different assets – for example, wind turbines, solar and battery storage – will have its own control system providing different data sets, and will use different communications protocols to transfer the data. This then makes it very difficult to visualise the data holistically to help optimise asset performance and profitability.

Emerson's comprehensive SCADA solution reduces complexity, as it can connect to all types of systems from different assets and OEMs, and handle all kinds of production and maintenance data from these systems in a single location. Maximising visibility into the data in this way makes it easier for operators to analyse it and gain actionable insights, thereby supporting improved decision-making.

To learn more about how Emerson's expertise and technologies are enabling smarter and more sustainable wind farm operations, visit Emrsn.co/IM1905

Ensuring quality within lithium-ion battery component manufacturing

Sergei Mishin, measurement solutions sales director OEM Europe, explains how automation technology is essential to optimised, precise and safe production of anodes, cathodes and electrolytes.



Global electric vehicle (EV) sales are growing and accounted for 10% of all new cars sold in 2022, but reports suggest that EV sales must increase to approximately 60% by 2030 to align with the net-zero emissions by 2050 target. The advancement of lithium-ion battery technology has been central to the emergence of electric vehicles. Over the last two decades, lithium battery manufacturers and the manufacturers of EV battery components including anodes, cathodes and electrolytes have worked extremely closely to develop materials that enhance the performance and safety of lithium-ion batteries. For component manufacturers it is essential to implement manufacturing processes and technologies that ensure consistent and assured production quality and safety, while at the same time minimising costly rework that impacts throughput and profitability. The continuity of the manufacturing process means that errors or impurities taking place at an early stage will accumulate, resulting in much larger consequences further down the production line. Quality needs to be monitored at every stage – from raw materials through to cell assembly – to maintain production efficiency and minimise waste.

Optimised production is also extremely important, not only to ensure quality despite raw material variation and maximise throughput, but also to provide manufacturers with the flexibility to meet customer requests for different battery component types and proprietary recipes. Typically, manufacturing is based on batch processes. Batch control provided by **Emerson's DeltaV Batch Analytics** software is designed specifically for this type of application. The key feature of this solution is that by learning from the past, the software is able to predict production outcomes. Multi-variate analysis of the process is performed based on models generated from a compilation of historical batches. Faults or deviations in the batch process are detected and identified in real time, giving operations the ability to take corrective action before a negative impact on production occurs. Should process parameters deviate from norms, it can evaluate whether the batch will still meet specifications and quality requirements or will fall outside specified parameters and require rework or disposal. This means decreased costs, reduced cycle times, increased yield, reduced waste, reduced variability and improved reliability.

Advanced measurement

Ensuring recipe consistency and production quality starts with accurate, reliable and repeatable measurements. Within a batch reactor application these need to monitor the addition of both raw materials and additives. Reactor heating and cooling, pressure control, overfill prevention and equipment condition monitoring rely on flow, temperature, level, pressure and analytical measurements. Precise control of material added to reactors and mixers is critical. Emerson's Micro Motion™ Coriolis meters are ideally suited for these applications because they measure mass flow of the liquid or slurry rather than volume, ensuring measurement accuracy. Cathode precursor pH measurement accuracy is critical to the final shape of colloids impacting quality, but the sulfides and hydrofluoric acid present a very tough environment and reduce sensor life, whilst oil layers on the sensor make measurement difficult. **The Rosemount RBI pH/OPR sensor** is highly chemical-resistant and designed for string layer resistance, ensuring measurement certainty and reducing maintenance requirements. It's important to understand the levels in reactors and mixing tanks to prevent damage to agitators caused by low level and protect against overfilling that presents safety issues. It can be difficult to accurately measure the level of metal slurry in a tank with an agitator that creates turbulence, changing the density of materials, which affects differential pressure-based level measurements, and viscous materials that would coat contacting technologies. **Rosemount non-contacting radar level transmitters** are well suited for these applications, as they can cope with these challenges. Their high sensitivity and unique software ensure that their performance is not affected by weak signals and turbulent conditions, while a process seal antenna protects against the corrosive media and high condensation levels.

Ensuring stable control and safety

Uneven chemical additives can lead to chemical waste and raw material inconsistencies creating costly product scrap. Reliable, precise and very smooth control is also essential to ensure process control strategies are implemented correctly. Typically, these applications are very challenging for valves, with abrasive and corrosive chemicals, slurries and powders flowing through the production process. Corrosion impacts the reliability and performance of valves, creating unstable flow control and also the possibility of leaks that create safety hazards for plant and workers. To maintain reliable operations and prevent safety and environmental issues, it is essential to ensure material compatibility. Emerson not only offers an extensive range of control valves suitable for severe service applications, but has the expertise to work with customers to select the appropriate technology and anti-corrosive materials to ensure high performance over an extended lifetime. For example, **Fisher™ valves** with hardened and ceramic trims provide good wear resistance, while Fisher vee-ball with its V-notch ball provides a non-clogging control solution. Emerson's Clarkson bi-directional valves feature a leak-free shut-off and are suitable for low and medium density slurries at low pressure (<10 bar) and high pressure (<20 bar). For powder handling applications, **Keystone™ F990 valves** feature a special design with a split body and one-piece disc-shaft that produces a high flow capacity and simplifies maintenance.

For manufacturers keen to focus resources on maintaining efficient production and continued product development, Emerson's leading measurement, control and electrical technologies, combined with a global network of application experts, and engineering solution services, make the company the ideal partner in this rapidly developing market. Emerson is uniquely positioned to be able to provide process control systems, a complete range of advanced measurement solutions and the world's most comprehensive range of final control technology.

To discover how Emerson's products and services can improve product quality, plant reliability and safety for EV battery component manufacturers visit Emrsn.co/IM1906

Overcoming carbon capture challenges helps meet **net-zero commitments**

Over the coming decades there will be a significant rise in the number of large-scale carbon capture, utilisation and storage projects around the world. Loic Charbonneau, global project pursuit director, explains how advanced automation solutions can help these facilities to operate safely and reliably.

Among the decarbonisation and environmental sustainability strategies being increasingly employed by heavy industry to reduce CO_2 emissions and mitigate climate change is greater investment in carbon capture, utilisation and storage (CCUS). According to the **Global Status of CCS 2021** report, there are fewer than 30 fully-operational commercial CCUS facilities globally, but it is envisaged that by 2050 there will be more than 2,000. Such an increase would see the worldwide operating capacity of CCUS facilities rise from 40 million tonnes per annum (Mtpa) to more than 5,600 Mtpa.

In the latest major CCUS projects under development, a cluster of different emitters – power stations, chemical plants, refineries and steel works, for example – are connected to a shared pipeline network, owned by a third-party operator. After being captured at source in a gaseous state, the CO_2 can then be purified and later compressed or chilled into a supercritical liquid state, before being either transported to a suitable deep underground storage location for long-term isolation from the atmosphere or used in a variety of industrial products.

CCUS is deemed a proven and safe process which can play a vital role in enabling organisations to meet their corporate commitments to net-zero targets and qualify for government incentives. However, it also presents certain operational challenges, which Emerson's latest advanced automation technologies are helping to solve.

Accurate and reliable measurement

Throughout the CCUS process, there are critical points where accurate, reliable and traceable measurement of the flow and density of the CO_2 is vital. For example, it is essential to know how much gas each emitter is injecting into the shared pipeline network, and for all parties to have confidence in financial transactions based on these measurements. It is also important to measure the amount of CO_2 being injected into the storage location. The changes that occur in CO_2 phase and density at this point can affect the accuracy of volumetric flow meters, so direct mass measurement provides the best option. The use of **Coriolis mass flow and density meters** enables challenging multiphase measurements to be performed when the CO_2 is in, or near, a supercritical state.

Gas analysis

Accurate analysis of the CO_2 stream is crucial for operational, safety and compliance reasons. Different types of impurities, including water, O_2, SO_X, NO_X, triethylene glycol and H_2S, may be present in the stream, depending on whether the carbon source is natural gas, post-combustion processes or direct air capture. To be permitted to enter the shared pipeline network, the composition of the CO_2 must fall within certain parameters relating to impurity levels, as well as water content, pressure and temperature. Concentration and composition measurement of the CO_2 and its impurities is therefore vital, and it is the responsibility of emitters to demonstrate compliance.

Helping them to meet this challenge, Emerson provides conventional **continuous gas analysers** that enable reliable inline gas analysis to be performed remotely, as well as gas analysers based on chromatography (Rosemount 370XA or 700XA Chromatographs) or Quantum Cascade Laser technology, offering fast, high-resolution spectroscopy measurements that deliver near-live data and trend information. This visibility into the process allows an emitter to take quick action if the impurity levels exceed the agreed limits.

Emerson has decades of experience in engineering, operating and optimising industrial facilities, and understands the unique challenges presented by CCUS projects. To support both emitters and pipeline operators in meeting these challenges, we provide a solution known as a CO_2 integrity station. This is a pre-engineered advanced work package incorporating a range of automation solutions to ensure that CO_2 integrity requirements are met through accurate and reliable measurement, monitoring, analysis and control.

CO_2 integrity stations can be deployed at every point in the process where measurement and integrity checks are required. Their base components include Rosemount X-STREAM continuous gas analysers, which provide real-time analysis of the CO_2 composition to a very high degree of accuracy, enabling multiple possible contaminants to be identified, even at very small parts per million. There are also **Micro Motion Coriolis**

> **"Emerson's pre-engineered solutions ensure that CO_2 integrity requirements are met through accurate and reliable measurement, monitoring, analysis and control."**

mass flow and density meters for extremely accurate and reliable measurements; emergency shutdown (ESD) valves and pressure safety valves to protect equipment; and a remote terminal unit (RTU) or flow computer that carries out flow rate computations and sends data from the measurement system package equipment to a central control point.

Corrosion, erosion and leaks

Loss of containment undermines the whole purpose of capturing CO_2, so leaks resulting from corrosion and erosion are a significant concern during all stages of the CCUS process. Dry gaseous CO_2 is not corrosive but the presence of moisture in the gas stream can cause the formation of carbonic acid, which presents a significant threat of severe corrosion to the carbon steel pipelines through which the CO_2 is transported.

It is therefore essential for operators to implement a monitoring system that enables them to gain visibility into pipeline corrosion and erosion. Emerson provides a broad range of automation solutions that help operators to maintain a leak-free process, including **wireless ultrasonic sensors** to enable continuous monitoring of pipeline wall thickness. In addition, software solutions can aggregate disparate pipeline and asset integrity-related data to help identify issues and perform more accurate risk modelling.

Corrosion and leak detection sensors are among a range of optional value-add technologies that can be implemented to enhance CO_2 integrity stations. End users also have the option of adding an RTU with edge analytics capabilities, and/or ESD valve diagnostics to help understand the health of these critical valves and ensure they will operate when required.

Additional technologies

Emerson's broad portfolio of advanced automation solutions also includes technologies that can provide further value throughout the CCUS process. These include predictive vibration monitoring for enhanced compressor protection; pipeline and subsea integrity and pipeline CO_2 **leak detection;** and AspenTech software for storage operation optimisation and reservoir monitoring.

To learn more about how Emerson's automation solutions and expertise can meet your CCUS challenges, visit Emrsn.co/IM1907

Accelerating the transition to **biofuels production**

Julie Valentine, director of global refining and sustainability measurement solutions, explains how advanced measurement and control technologies are helping organisations to meet the challenges of producing clean fuels and reducing the environmental impact of their operations.

The target of neutralising carbon-based greenhouse gas (GHG) emissions by 2050 has prompted process and manufacturing companies around the world to roll out environmental and social responsibility (ESR) initiatives, often incorporating bold plans to decarbonise their operations. For many refiners, this has led to investment in the processing of bio-based feedstocks. The variable availability and pricing of bio-based feedstocks means that plants need to be designed with flexibility in mind, enabling them to process a variety of such feedstocks in the future. At the same time, producers are looking to continuously improve their carbon intensity (CI) score, which is used to determine how many financial credits they will receive.

The CI score is calculated by measuring all GHG emissions associated with the production, distribution and consumption of green fuels. It can be improved by feedstock selection but also by digitally transforming operations, implementing advanced measurement and control technologies to optimise processes and reduce energy consumption and emissions. Typical examples can be found in the areas of custody transfer, mass balance, energy management and emissions management. Other examples include pervasive sensing and wireless technologies utilised to monitor critical assets, and also technology enhancements to safety instrumented systems and corrosion monitoring.

Mass balance

A good mass balance is vital for complex plant processes, and achieving that balance requires accurate and reliable level and flow measurement. The specific gravity and viscosity of feedstocks can vary by up to 10%. The accuracy of traditional level and flow measurement technologies is impacted by these varying fluid properties and ambient conditions, and as a result can affect the unit mass balance, reactor control and production plans. However, the latest smart flow metering systems and advanced level measurement instrumentation can handle different fluid properties in a wider range of environments. Coriolis mass flow meters offer the flexibility needed to accurately measure multiple feedstocks at varying process conditions without requiring recalibration or temperature and pressure compensation.

Pervasive sensing

Like any other process or manufacturing organisation, biofuels producers are focused on increasing the efficiency and profitability of their plants. An important factor in helping to meet this challenge is finding ways to increase the reliability and performance of essential plant assets. **Pervasive sensing** supports the monitoring of assets such as pumps, compressors, heat exchangers and steam traps, using a broad range of wired, wireless and non-intrusive sensor technologies. These sensors (monitoring vibration, temperature, pressure and flow, for example) are easy to install and can be used with pre-packaged analytics to enable faster identification of issues and improved maintenance scheduling and equipment availability. One of the most important applications is **heat exchanger monitoring**, as the efficiency of heat exchangers is critical. Very few heat exchangers have enough sensors to accurately monitor their efficiency, but pervasive sensing technologies enable this to be achieved.

Pervasive sensing applications can be deployed at the edge, on-premises, or in the cloud. Because standard templates have been developed for each application, this provides a very cost-effective solution for monitoring essential assets. The asset health information produced can be made available to relevant stakeholders via tablets or smartphones, and sent to the plant historian and enterprise level systems.

Data management

However, making best use of the wealth of available data can be challenging. Aggregating data in a central repository is common, but companies often find themselves drowning in swamps of data they can't use. Emerson's **Plantweb digital ecosystem** platform features data lake tools that aggregate, historicise and organise the information required for reports and analytics, as well as integrated visualisation tools and KPI dashboards, all with real-time secure remote access. This technology makes it possible to effectively automate the entire regulatory data gathering, analysis, visualisation and reporting workflow, with the flexibility to accommodate future fuel standards and inevitably changing requirements.

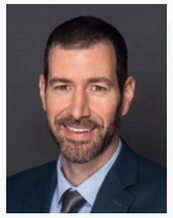
Corrosion monitoring

Corrosion is one of the most significant challenges associated with biofuels production. For existing refineries, re-purposing hydrotreaters for biofuel production may often require a metallurgy upgrade to mitigate corrosion concerns with processing feedstocks with a high free fatty acid content. Furthermore, the conversion reactions in biofuel units produce more water and CO_2 compared to traditional refining units, resulting in potential carbonic acid corrosion concerns downstream of the reactor.

While metallurgy upgrades are the first step for minimising corrosion, a secondary step of implementing online **corrosion monitoring** is recommended. Wireless ultrasonic-based sensors, combined with pre-built analytics software, enables real-time corrosion monitoring on critical vessels and pipework. Easy-to-install clamp-on sensors measure pipe wall thickness without process interruption, whilst the software analyses the sensor data. The ability to detect and act upon corrosion before a breach occurs in a vessel or pipework reduces the risk of safety incidents and unplanned downtime.

To learn more about how Emerson's advanced technologies meet the challenges of biofuels production, visit Emrsn.co/IM1908

Fast, safe and reliable **hydrogen fuel dispensing**



Brandon Bromberek, vice president for oil and gas measurement solutions, explains how Emerson's broad portfolio of advanced automation solutions and extensive industry experience help to meet measurement and safety challenges at hydrogen fuelling stations.

New infrastructure is rapidly being developed to support the growth of the hydrogen mobility market, with 685 hydrogen fuelling stations in operation across 33 countries worldwide by 2021. Hydrogen fuel dispensing presents various challenges for automation technologies but these are being met by the latest advanced solutions, helping to ensure fast, safe and reliable vehicle-filling operations.

Metering confidence

To meet consumer expectations and ensure correct billing, hydrogen dispensing equipment must deliver the desired amount of fuel quickly and safely every time. Accurate and reliable flow control and measurement solutions are therefore essential. Emerson has vast experience across the hydrogen value chain and has developed a range of advanced flow technologies for hydrogen fuel dispensing operations.

The Micro Motion Coriolis HPC015 flow meter, for example, has been designed specifically for hydrogen fuel dispensers. It provides outstanding accuracy which is unaffected by the high pressure and cold temperature of liquid hydrogen. To ensure continued accuracy, Smart Meter Verification functionality monitors key performance indicators, including calibration verification, to identify issues at an early stage. The HPC015 has been certified for use in hydrogen fuelling applications by both SAE International (formerly the Society of Automotive Engineers) and the American Society of Mechanical Engineers.

Hydrogen fuelling station pumps typically offer two pressure options for dispensing – these being 700 bar for light vehicles such as passenger cars, and 350 bar for heavy duty vehicles such as buses and lorries, which have larger tanks. **TotalEnergies Gas Mobility has implemented the Micro Motion meters** within both its 700 bar and its 350 bar hydrogen dispenser designs, which have received certification from leading independent specialist the Netherlands Measurement Institute. These dispensers are now in use at TotalEnergies' hydrogen refuelling station in Arnhem, The Netherlands.

Flow control

With hydrogen dispensed at high pressure in liquid form, it must be stored at -40 degrees Celsius to prevent it from reverting to a gas. All instruments, valves and final control elements within the fuel dispenser must be able to perform reliably under these cold, high-pressure conditions, to ensure accurate flow measurements and tight shut-off, preventing hazardous leaks. Components that come into contact with the hydrogen must also be constructed of materials that are resistant to the effects of permeation and embrittlement, to prevent cracking.

Emerson provides a broad range of advanced fluid control solutions able to perform reliably in this harsh environment and therefore support safe and precise fuel dispensing. These include the **TESCOM™ Anderson Greenwood Instrumentation H_2 Valve Series**, designed for isolation purposes in high-pressure applications such as hydrogen fuelling stations. The valves use steam seal technology that provides consistent pressure containment with low operating torque, thereby minimising potential leakage and increasing safety. The Emerson portfolio also includes **ASCO Series 320 Solenoid Valves** for precise, safe and reliable flow control; and **TESCOM ER5000 Series Electropneumatic Actuators** and **TESCOM 26-2000 Series Venting Pressure Regulators** to provide precise pressure control over the hydrogen flow and pressure. Technologies such as these help improve the pressure handling capabilities of hydrogen fuelling stations, which in turn enables motorists to reduce their fill-up times to around three minutes.

Ensuring safety

There are always hazards associated with fuel storage and dispensing. Hydrogen presents a particular danger because of its low ignition temperature and ignition energy, wide explosion limits and quick combustion speed. It is therefore essential to install technologies that help to minimise the risk of gas leaks, hydrogen flames and explosions.

Hydrogen gas leaks must be detected immediately, before becoming hazardous. However, because hydrogen is odourless, colourless and tasteless, leaks are difficult for human senses to detect, so it is vital to install reliable continuous automatic monitoring. Technologies such as catalytic and electrochemical point sensors have traditionally been used for this task. However, these rely on the leak being close to the detector and can fail to detect it if the gas is dispersed quickly.

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Ultrasonic technology provides a better solution, with devices such as the **Incus Ultrasonic Gas Leak Detector** from Emerson utilising ultra-sensitive acoustic sensors to continuously monitor wide areas for ultrasound generated by gas leaks. This technology is unaffected by wind direction changes or gas dilution, and there is no need for the hydrogen to reach the sensor, as it is the sound of the gas leaking that enables detection and triggers an early warning.

Flame detection

Should a gas leak be ignited, it is crucial to detect the flames as quickly as possible, to protect personnel and assets. Flame detection technologies have traditionally worked by responding to heat or smoke, but they require the fire to reach a certain threshold before enough heat or smoke has accumulated to be detected. The latest detectors instead use optical technologies to detect fire.

Hydrogen flames are almost impossible to see with the naked eye, but optical flame-sensing technologies detect the electromagnetic radiation emitted by flames. The compact **Rosemount 975HR Multi-spectrum Infrared Hydrogen Flame Detector** from Emerson has been specifically designed to meet the challenges of detecting hydrogen flames. Supporting fuel dispensing safety, it provides longest-distance detection of hydrogen flames at up to 90 metres (295 feet) and in under 50 milliseconds. Able to handle operating pressures of up to 15,000 PSI (1,034 bar), the Rosemount 975HR provides unparalleled reliability and the highest immunity to false alarms.

Emerson is unique in being able to offer all these different solutions, and alongside its industry experience and expertise, this makes it the ideal automation partner to support safe and reliable hydrogen fuel dispensing projects. To discover more, visit Emrsn.co/IM1909

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