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Three trends in hydrocarbon processing gas analysers

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Step-changes in equipment functionality, an array of digital solutions and innovative service delivery are teaming up to transform the landscape of refinery gas analysers. These three trends are combining to result in significant benefits: reduced CAPEX, simpler operations and a lower cost of ownership.

As refiners focus on process automation for margin improvement and legislation drives deeper emissions monitoring requirements, additional gas analysers often feature on the CAPEX budget. Spending that money wisely will make a difference to the cost of ownership and bolting on service packages can drive simplicity and OPEX reductions. So, it pays to stay well informed as these three trends transform supply and use of CEMS and process control gas analysers.

1. Digital solutions

Modern gas analysis instrumentation incorporates cutting edge analytical chemistry. The miniaturisation that has been achieved in building rapid response and highly accurate gas analysers is staggering. The technology that is wrapped up inside these instruments has immediate parallels to the electronics sector. With this background, it is no surprise that gas analysers are leveraging digitalisation. Augmented reality, cloud computing and QR Codes are three examples of digital developments that are helping service engineers keep gas analysis hardware in top condition.

David Lincoln, Global Digital Lead at ABB's Measurement & Analytics Division explains why digital solutions matter: "the right combination of digital technology, service delivery and high-tech hardware puts us in the sweet spot to provide unrivalled value for money to our customers".

As part of the ABB Ability™ suite of digital solutions, 'Remote Insights' allows an operator's instrument technician to communicate directly with an expert remotely. It is a two-way video and voice augmented reality interaction enabled by a hand-held device such as a tablet computer or mixed reality headset. It means that the instrument technician can share what they are seeing directly with their counterpart at ABB and get instant feedback about the best course of action. Lincoln says that "in the past, training, maintenance, troubleshooting and repairs all meant a service call-out. With Remote Insights, there will be much less travel required – saving time, cost and CO₂ emissions".

'Remote Assistance' is ABB's new collaborative cloud-enabled operations concept. Many refineries operating within a large company have implemented 'Remote Operations Centres'. These are like the 'Remote Assistance' model. The concept relies on condition monitoring health diagnostics in the gas analysers, which can let the instrument engineer, or the service team at ABB know the status of the gas analyser. This data can be used to diagnose consumable materials replacement requirements or troubleshoot equipment faults. The goal is to guide the local operations team towards a speedy resolution. Dynamic QR codes are a digital innovation that is being integrated into the ABB Measurement Care service, helping refinery operators get closer to 100% uptime availability for their gas analysis instrumentation. This uptime target is important for many process control applications but has special significance in regulated hydrocarbon processing continuous emissions monitoring systems (CEMS) for environmental compliance. In many countries, emissions measurement data must be reported 98% of the time to avoid shutdowns and penalties. The Dynamic QR code displays the latest system configuration data and the real-time analyser status. It communicates with a proprietary app called 'my Installed Base (myIB)' and can be scanned using a smartphone. The instrument owner can transmit real time information so that an ABB engineer can offer advice immediately or follow up with a site visit to fix the issue.

Picking up on another mega-trend, Lincoln adds that "data privacy and data security are key topics in this digital age. The Dynamic QR code technology is sensitive to this issue because there is no permanent physical connection needed to transfer data from the operator's gas analysers to our systems".

2. Innovative services

Maintenance can be avoided if it can be shown to be redundant. That saves time, cost and improves safety. Digitalised services, such as the ABB Ability™ Condition Monitoring solution, have enabled service teams to work with instrumentation engineers to review the health and status of their gas analysers. Fixing little glitches before they escalate.

Adrian Heaton, Global Service Sales Manager for the Measurement & Analytics Division at ABB outlines a recent case where the trio of low-maintenance CEMS gas analysers, digital solutions and field service teams teamed up support a major operating company in Italy. "Our customer was targeting immediate cost-savings and looking for a reliable service provider to support their installed CEMS gas analyser base across their 13 sites. To meet the cost-saving target, we offered a holistic approach. That included a standardised maintenance strategy across their sites with rapid response and optimised routine services. Condition monitoring was also implemented. The monthly review of the CEMS devices resulted in better emissions data reporting uptime and yielded a reduction in labour costs".

Gas analysers are like cars, they contain components which wear and required consumables that need to be replaced to maximise the life of the equipment. Heaton adds that "car owners often opt for factory defined maintenance schedules and genuine OEM parts. Using ABB accredited services ensures that instrument technicians can be sure that ABB best practices and factory schedules are followed precisely".

Offering a tiered range of services to refineries so that they can get what they most need whilst working within a budget makes good economic sense. Again, the car analogy works well. The base model is available to all. And some buyers elect to add on parking sensors, a sunroof or an electric boot hatch. "In a similar vein, ABB offers tailored Measurement Care packages which can include just the basics, or a full range of life cycle services in a single agreement" concludes Heaton.

The trends for services related to hydrocarbon processing gas analysers are to offer more; to integrate them more closely with digital solutions and to offer more flexibility about how the services are consumed. "We will be there during the full lifecycle of a gas analysis instrument" says Heaton. "Our services begin with product selection proposals, equipment installation, commissioning and training. In the operational phase the focus shifts to spare parts,

consumables, maintenance, technical support and repairs. As time moves on, extensions, upgrades and retrofits are the order of the day. And, when twilight finally comes it's time to consider replacement and end-of-life services. Our Measurement Care packages are a modular framework which allows each refinery or gas processing plant to customise a service package that meets their needs".

3. Step-changes in hardware

The right gas analysis hardware can make a big difference. Stephen Gibbons, Head of Product Management for the Continuous Gas Analysers product range at ABB Measurement & Analytics, says: "The kit inside the box really matters. We are on a mission to control our customer's costs, cut complexity and make their CAPEX go further. That's why we work tirelessly to continuously improve our comprehensive gas analysers product range.

"Take the example of combustion optimisation and CEMS from a steam methane reformer (SMR) producing hydrogen for hydrotreating or hydrogenation on the refinery. These processes are essential to produce clean burning low-sulfur fuels and biofuels. Our Advance Optima product range can bundle together all the gas analysers that a refinery would need for their SMR emissions monitoring with one controller. It means simplicity and cost-effectiveness".

Staying with SMRs but switching to process and quality control applications, direct read NDIR analysers are ideal for measurement of the final hydrogen purity. Gibbons points out that "what really matters in refinery hydrogen purity is the absence of CO and CO₂. These gases can poison to the hydro-treating catalysts in the subsequent processes. Typically, the final hydrogen product specification will have a maximum total combined CO and CO₂ content of 10 parts per million by volume (VPM). Simultaneous measurement of these two components is exactly what our Uras26 NDIR gas analyser does best".

Using an NDIR gas analyser is nothing new for CO and CO₂ measurement, but the ABB instrument uses cells filled with calibration gas mixtures of known concentrations. These enable automated calibration of the gas analyser, thus eliminating the need for test gas cylinders. Regular calibration of the CEMS instrumentation is a fundamental requirement for emission monitoring compliance and the Uras26 has plenty of international certifications to validate this hands-free calibration technique. It ultimately means reduce maintenance which helps to achieve regulatory compliance with reduced cost and complexity.

Diving down one layer deeper, analysis of the total oxides of nitrogen (NO_x) in the steam methane reformer emissions is an area where the trend for gas analyser hardware is simplification. It has been common in the past to use the chemiluminescence (CLD) analytical technique to measure NO_x. The instrument needs an ozone generator and a catalytic converter operating at 300°C to oxidise NO to NO₂. That is a lot of technology to pack into an instrument intended for use in rugged industrial applications.

Furthermore, the CLD technique cannot differentiate between the two common oxides of nitrogen: NO and NO₂. On the other hand, the Limas gas analysers which ABB offers for NO_x measurement are simple and robust UV gas analysers that can separately detect NO and NO₂. That is a real step-change in performance. At present this 'speciation' gives an even greater level of environmental emissions visibility than is generally required, but as legislation shifts, the purchase of a gas analyser which can perform at this level can be considered as future-proofing the CAPEX investment.

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