IDENTIFYING AN INVISIBLE THREAT – AIR QUALITY MEASUREMENT AND EMISSION MITIGATION

Stories around sustainability and the environment are often accompanied by striking imagery. Plastic waste floating in the ocean, lush forests, and colourful wildlife are all common sights alongside environmental headlines – but one of the most pressing threats to our planet and everything that lives on it is invisible.

Air pollution continues to have a dramatic impact on all aspects of our environment. It affects global warming, wildlife, and public health. When visualising air pollution, it's easy to picture power station chimneys belching smoke, or a Dickensian smog that hangs over our streets. However, the truth is not quite so simple, and air pollution is often much more insidious.

While advances in technology and legislation - such as the 1956 Clean Air Act - have significantly reduced the appearance of lethal smog, the UK has still been in breach of its legal limits for key pollutants since 2010. And, with several factors driving emissions of gases and tiny particulate matter (PM2.5) - including an increase in wood burners caused by rising energy prices, and rising use of ammonia-based fertilisers - the government does not expect to meet these obligations until at least 2030.

Businesses have a huge part to play in driving down emissions, but it is impossible to achieve this without a solid foundation of accurate, detailed data to inform policy. And it is impossible to acquire this data without the intelligent sensors required to collect it. By using sensors to inform hazard mitigation and other ESG policies, businesses can maximise safety, minimise disruption and downtime, and protect people and assets.

A clear direction of travel

There is an almost uniquely strong consensus around sustainability. Broadly, consumers, businesses, and lawmakers all agree that more must be done on the issue. And as every business is responsible for at least some emissions throughout their supply chains, every business has at least some part to play.

As events like the annual COP conferences continue to focus minds on climate change policy on a global scale, the direction of travel is only moving one way – however slow it might be. If corporate image protection and consumer pressure were not enough to deliver that focus, then stricter environmental regulations such as mandatory government climate risk disclosures certainly should be.

The climate risk disclosure rule, proposed by the globally influential US Securities and Exchange Commission (SEC), would require public companies to provide more detailed reporting of emissions produced and any other environmental risks, as well as net zero plans. This has huge implications for everyone working at publicly-traded companies, from the executive level down – not least because the UK, EU, Japan, and other key markets are following suit, with an end goal of a standardised reporting system.

If any business is not at least making tentative plans for these sweeping changes – and proactively getting ahead of other changes yet to be proposed – they risk being caught off guard by new legislative burdens that could severely hamstring productivity.

Transparency around the threat we face

Whatever form these legislative changes take, and no matter how broad or specific they might be, they will all share a common theme: improved transparency. This means robust data collection is at the core of our planet's future.

In many industries, this manifests as an increased focus on health, safety, environmental, and social policies, collecting data to inform new and improved ways of working. Far from a simple box-ticking exercise or another length of red tape to throttle productivity, these measures should be seen as an opportunity to streamline and heighten productivity, resulting in less waste and higher quality products.

The sensing technology required to secure that future is available today and is more affordable and accessible than ever. Any company can monitor their industrial gas usage, emissions, or even just the general air quality around its workplace.

Laser absorption spectroscopy is a powerful tool for detecting trace gases, and has a particularly big role to play in tackling the 'low hanging fruit' – the emissions that have the biggest impact on climate change. Carbon dioxide (CO_2) and methane (CH_4) are classified as greenhouse gases due to their ability to strongly absorb infrared light emitted from the Earth's surface, which effectively traps infrared light emitted from Earth as heat and contributes to the warming of our atmosphere. However, infrared spectroscopy can be used to exploit the infrared absorbing property of CO_2 and CH_4 and determine the atmospheric concentrations of these gases.

Getting on the right wavelength

This type of spectroscopy is widely used in the monitoring of atmospheric greenhouse gases, pollution, and respiration processes. It can even be used to analyse the particulate matter in human breath, allowing for a detailed breakdown of the particles that enter and leave our lungs with every breath we take. The detection is based on how light is absorbed as it passes through a medium.

Emitters within the sensor generate beams of IR light which pass through a sampling chamber containing a filter. The filter blocks out light of a certain wavelength, meaning only the required wavelengths make it past the filter to reach a detector. This detector measures the intensity (or attenuation) of the IR light, which can determine the precise concentration of gas that may be present. Different filters allow different wavelengths of light to reach the detector, which can, in turn, be used to detect different gases and distinct particles.

Newer gas analyser instruments use a laser diode mounted on a thermo-electric cooler to tune a laser's wavelength to the specific absorption wavelength of a particular molecule. They exploit their high-frequency resolution, which results in enhanced sensitivity - more significant levels of interaction between gas molecules and light in the order of parts per billion - and discrimination, as they are tuned to specific gas compounds. This eliminates the potential for false alarms, which can become a real issue with other commonly used gas detection technologies.

The benefits of these sensors include fast response times and accurate results without using any additional gases to operate. This technology has advanced to the point of detectors that continuously monitor for combustible gases and vapours within the lower explosive limit and provide alarm indications. These can be deployed within oxygen-deficient or enriched areas, require little calibration, and are immune to sensor poison, contamination, or corrosion.

And, as the requirement for transparent data around air quality has dramatically increased from a variety of stakeholders in recent years, sensor manufacturers are demanding increasingly high-performance filters at competitive prices.

Painting a picture of the invisible

Air pollution measurement instruments serve multiple purposes. They can help businesses comply with environmental legislation and keep their employees safe. However, they can also help with the release of detailed information that can be used to inform the public through warnings, emergency alerts, and general education. Having real-time data on hand can ensure that the right people act when needed and control measures can be put in place and continuously evaluated. This will help employees and the public safeguard themselves and take action – however small – to remedy the problem, just as they might work to reduce energy waste or recycle to help combat other factors harming our environment.

It is impossible to deal with a problem that we are unable to accurately describe. By identifying this invisible problem, we can begin to mitigate and even eliminate harmful emissions from many industries. When so much of the environmental agenda is focused on our forests and seas, it is important not to lose sight of our air quality.

Through precise sensing technology, we can paint a picture of the invisible – only then can we secure our future.

Fig 1 - Capturing the mind-boggling amount of natural gas - or methane - wasted each year across the oil and gas industry would mean progress for both the climate crisis and the energy crisis.

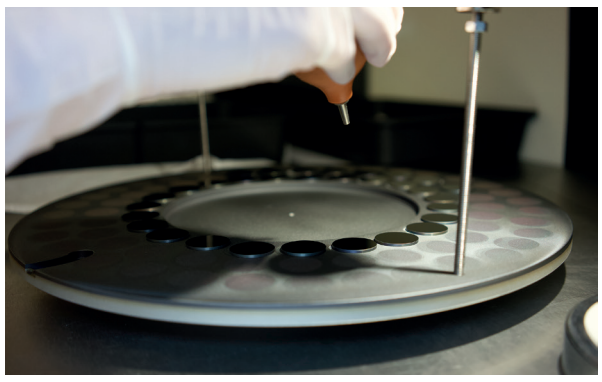

Fig 2- Corporations leading on climate action are looking for the next generation of climate technologies to invest in and scale to meet deep decarbonisation targets.

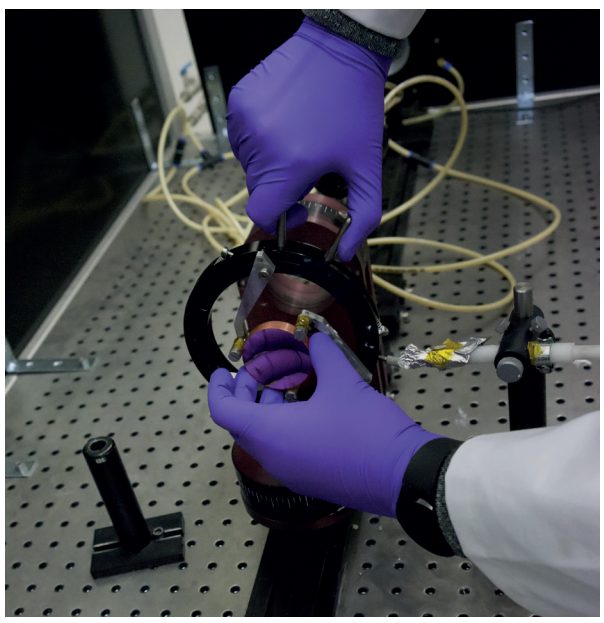

Fig 3 - Umicore is a global leader in the design and manufacture of precision IR Filters. Widely used to detect the presence of noxious or flammable gases in the atmosphere, IR Filters are a key component of preventative maintenance safety systems critical to the Oil, Gas, and Energy sector.

Gasir Lens - Umicore's GASIR® chalcogenide glass is an ideal material for both high-performance infrared imaging systems and high-volume commercial applications.

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