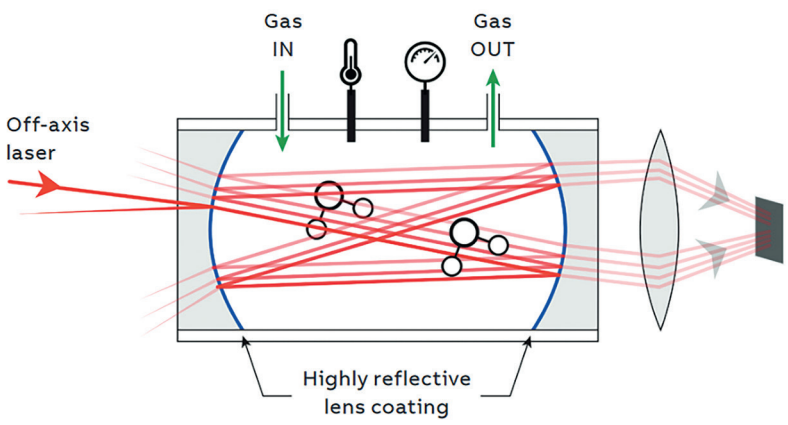
ADVANCED LASER TECHNOLOGY HELPS MEET METHANE PLEDGE

Carbon emissions have long been the focus of global efforts to reduce the impact of industrial activities on the environment, however the reduction of methane emissions to our atmosphere could have a significant and fast acting impact on the pace of global heating. Gary Egerton, Business Development and Sales Manager at ABB Measurement and Analytics explains how advanced laser technology is helping to meet ambitious pledges to reduce methane emissions globally.



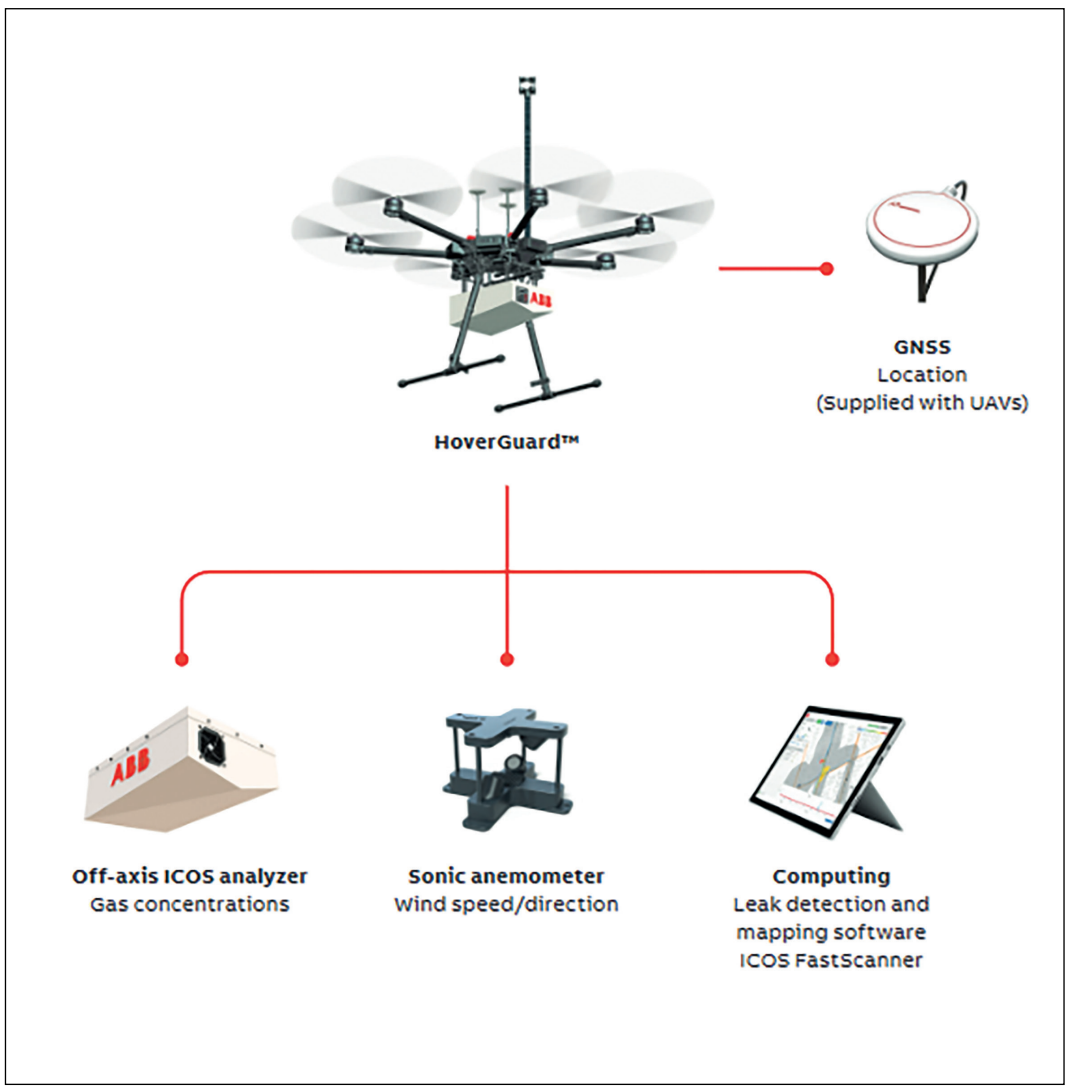
With mitigating climate change on everyone's agenda these days, it's not surprising that efforts to limit one of the biggest culprits, Carbon Dioxide (CO_2), are well advanced. Governments set targets and pledge to control CO_2, to become 'Net Zero' carbon emitters, companies are urged to reduce their carbon footprint and individuals are encouraged to use less electricity and choose more carbon neutral forms of transport.

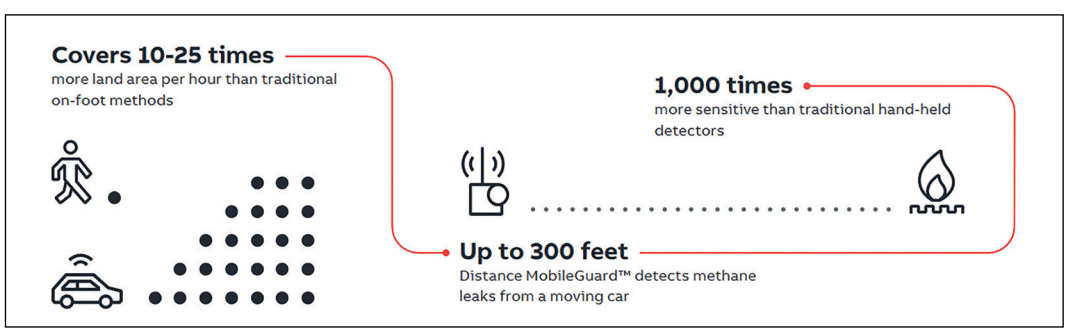
Although a major contributor to climate change, CO_2 is not the most potent greenhouse gas – that title goes to methane, which is around 25 percent more potent at trapping heat, and therefore leads to a more powerful warming effect in the atmosphere.

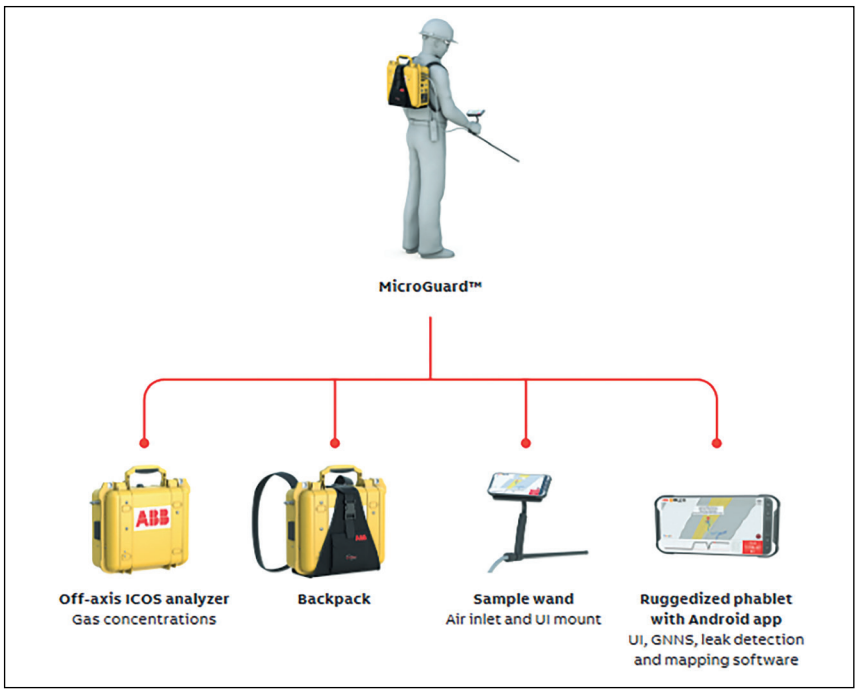
Methane's potentially damaging effects are taken seriously, so much so that over 100 countries have pledged to cut methane emissions by 30 percent by 2030, with the aim of preventing 0.3 C of warming by 2040[1].

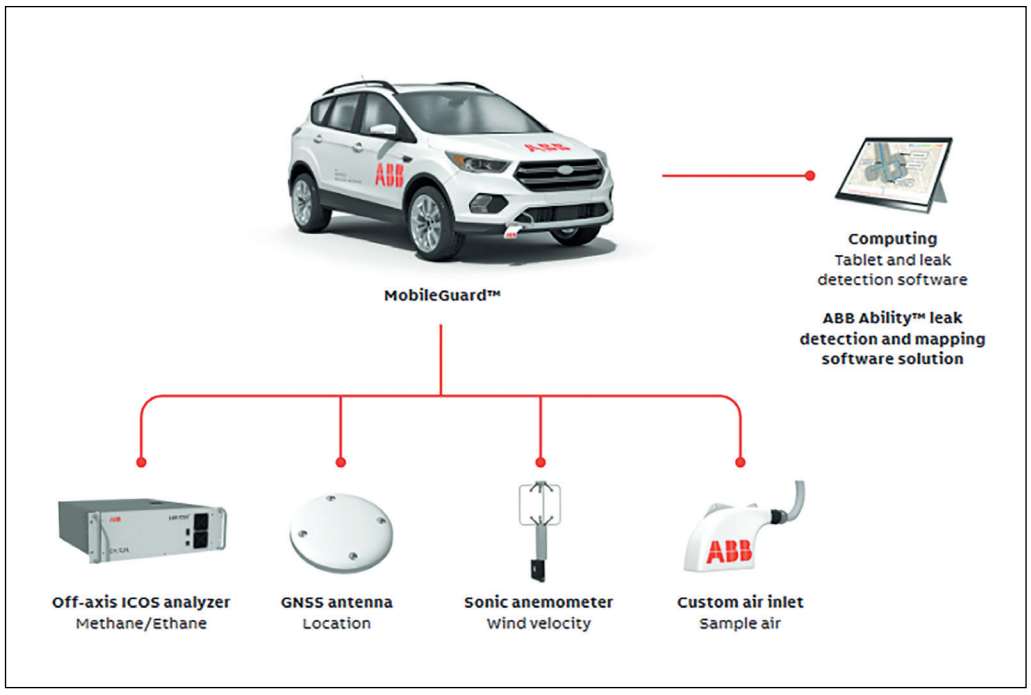
There are many natural sources of methane across the globe, including wetlands, coal beds and landfill sites, but by far the most significant source is the production and distribution of natural gas.

Methane makes up between 70 and 90 percent of natural gas, along with ethane, butane and propane. A reliable source of energy, it is expected to play a major role as a transition fuel as we reduce our reliance on fossil fuels like coal and oil, and in lieu of more permanent, non-polluting technologies.









As natural gas is expected to be the only fossil fuel to show growth in the coming years[2], with a predicted 30 percent increase in production to meet rising energy demand, avoiding its release to the atmosphere is critical[3].

Detection methods need an upgrade

Pipelines are the most cost-effective way to transport natural gas, particularly as many gas fields are in areas remote from the consumers and industries that need gas.

The drawback is that pipelines carry a significant risk of leaks. These can have numerous causes, including excavation that damages the pipes, accumulation of snow and ice on pipes and meters, incorrect pressure in the gas system, equipment failure or corrosion and natural events such as earthquakes and floods.

As well as contributing a significant global warming load, methane leaks result in lost revenue amounting to billions of dollars a year, and also pose a serious safety risk.

Clearly, pipeline operators need a rapid and accurate way of detecting leaks, one capable of detecting smaller leaks over extended distances.

Unfortunately, many currently used techniques struggle to achieve this. Handheld analog devices need to be caried by technicians over the suspected leak area, as the system tests the air volume only every few seconds. A slow and cumbersome method, the detection devices also have to be calibrated on site, taking more time, while the data gathered also has to be entered by hand into reporting systems, adding further delays.

Essentially, a gas leak detection method needs to detect leaks at very low levels, provide an accurate estimate of their location and also be able to estimate the volume of the emission event.

Taking methane detection to the next level

The limitations of manual methods means that the pledge to cut methane could be seriously compromised – quite simply, countries and gas infrastructure operators need something much quicker and more capable if they are to make serious inroads into the numbers of methane gas leaks.

Many companies are conducting research into new detection and analytic methods, among them ABB, which has developed its Ability natural gas leak detection solution. This is based on Off-Axis Integrated Cavity Output Spectroscopy (OA-ICOS) technology, the latest development in tunable diode laser absorption spectroscopy.

OA-ICOS uses a tunable laser source that produces light at a selected wavelength that interacts with the gas being analyzed. The method involves the laser beams entering a highly reflective cavity, bouncing around many thousands of times before exiting the cavity and being picked up by a photon detector. This in effect creates an optical path many kilometres long, increasing the sensitivity of the measurements and producing a strong absorption as the light interacts with the gas that is let into the cavity. The tunable aspect comes in when the wavelength of the laser light is changed, allowing the concentration of the gas to be measured with high accuracy.

This method offers a sensitivity that is 1,000 times higher than conventional leak detection methods. A detector based on OA-ICOS can detect levels of gas of the order of parts per billion and can do so every second. This allows it to measure concentrations of gas from long distances, something not possible with other technologies.

Increasing speed and range

The technology dramatically improves the speed and range of methane detection and ABB has developed practical solutions that take advantage of these benefits.

One of these solutions is MobileGuard™ a vehicle mounted solution that allows gas to be detected from a moving car. As well as the OA-ICOS analyser, it combines data from an anemometer for wind speed and direction and a Global Navigation Satellite System (GNSS) antenna for pinpointing locations. Combining their data with gas concentration measurements, MobileGuard can locate, map and quantify pipeline gas leaks far from the emission source and while travelling at speeds of up to 55mph.

This allows the system to cover 10 to 25 times more land area per minute than traditional methods.

The technology can also take to the skies with the HoverGuard solution. This overcomes the phenomenon of methane leaking and then mixing with the air, decreasing in concentration. Using a drone, the detector can be carried through the diffused methane, calculating its concentration very quickly.

HoverGuard can gather accurate concentration data over large areas at speed, offering a rapid, low cost and safe solution to identify potential leaks. The solution is also useful for reaching hard to access areas such as bridges and tall buildings, areas with restricted access or which present hazards for people.

The drone can cover 10-15 times more land area per minute than traditional methods, while it can also quickly detect leaks more than 100 meters (328 ft) from their source.

Walking surveys can also make use of the detection method via the MicroGuard solution. Using an OA-ICOS analyser, backpack and tablet ruggedized for outdoor use, a GNSS and a dedicated sample wand, technicians can locate suspected methane leakage sites within a few minutes.

All these solutions offer facilities to store and transfer data. For example, MobileGuard and Hover Guard can transfer data and analyses securely to cloud storage for easy sharing and further analysis. MicroGuard™ software also generates comprehensive digital reports of the survey which can be shared immediately.

There is also a fixed solution designed to provide constant monitoring of potential gas emissions near high risk, sensitive areas such as schools, hospitals and other public places. Known as EverGuard, the solution consists of ABB's micro portable multi-gas analyzer (GLA131 Series) installed in a weatherproof NEMA 4X enclosure.

Several optional modules are available depending on the power and communications needs of the site. These can include a solar panel, an uninterruptible power supply, a cellular transmitter, a Wi-Fi router, a GNSS receiver, a weather station, or a multi-inlet sampling manifold. The modules allow EverGuard to meet the most stringent requirements of almost any application requiring continuous monitoring of natural gas leaks.

With rapid and accurate analysis, convenient data sharing and reporting and the ability to cover any site or situation, ABB solutions are transforming the way methane is detected, bringing delivery of methane pledges one step closer.

References

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