LEADER IN HYDROGEN MEASUREMENT

# ArchiGazette 05

July 2025


## IN THIS ISSUE

# 1x Archigas = ∞ possibilities?

**$H_2$ measurement and more: as different as the areas of application are, there is a sensor technology that fits**

We know: Every plant manufacturer – in electrolysis, for example – wants to produce an optimum solution. Whether it's a fundamentally new design or a modification to an existing setup – the respective design should achieve the best product results, meet strict safety standards and offer a top price-performance ratio as well as easy installation and handling. In short: you want nothing less than for everything to fit perfectly. And this requirement clearly also applies to the accompanying gas analysis – that's it.

No matter how different the areas of application and design solutions of the users are – the measurement of hydrogen and other gases must therefore meet their high demands and requirements exactly. So far so obvious. However, experience has shown that in many cases conventional options for gas analysis do not adequately meet the individual needs of the industry, are slow, imprecise and unstable, and often require complicated and expensive additional custom designs.

In contrast, with our gas analyzers based on our microsensor technology, we at Archigas offer a solution that can fully exploit its multi-talent flexibly and in growing fields of application. A gas analysis that literally "fits" and offers possibilities not only in the fields of electrolysis and fuel cells, but, what some may not yet know, also for measuring $H_2$ in $CH_4$ or helium!

But why not get a clearer picture: find out more about the diverse options offered by our sensor technology and background information on individual areas of application below. Or start by reading the sound bites from users who talk about their personal experiences. Also get to know our extended team. We hope there is something of interest for everyone.

Illya und Wladimir

## Users in their original voice

# “We can ABSOLUTELY recommend the device”

**When a reputable device provider talks about the advantages of its solution, it also provides well-founded arguments for its statements. Of course, the words of independent users carry particular weight. After all, they experience the products in daily use. We therefore asked some of them openly about their personal experiences with gas analysis from Archigas.**


*“We monitor, measure and control the atmosphere in our electrode boilers. This is because the boilers heat the water with electrodes and separate the water into various gases. We require to control the atmosphere in the electrode boilers and have chosen to use echnology from Archigas. Alongside, that we have good experience with this technology, we also experience professional dialogue with Archigas staff.”*

**Morton Hildebrandt Jensen, Fjernvarme Fyn**

*“We use the solution in the areas of catalyst testing and contract research. The device is durable and accurate. We can ABSOLUTELY recommend it and will continue to use it in the future. In our application, it has replaced an expensive quadrupole mass spectrometer.”*

**Erik Abbenhuis, Hybrid Catalysis BV**

*“We use the TCD3000 SiA in an AEM electrolysis test bench. The sensor is characterized by a very stable measurement signal and low drift with simple and uncomplicated calibration. Even the smallest quantities of gas are sufficient to obtain plausible values. By using the sensor in the oxygen line of our electrolysis systems, we can quickly and reliably detect hydrogen crossover across the membrane and potential membrane and seal damage very accurately. The sensor itself can be implemented and put into operation easily and without great effort. A practical feature is that it can also be installed in confined spaces due to its compact size. We will be equipping further systems with the device.”*

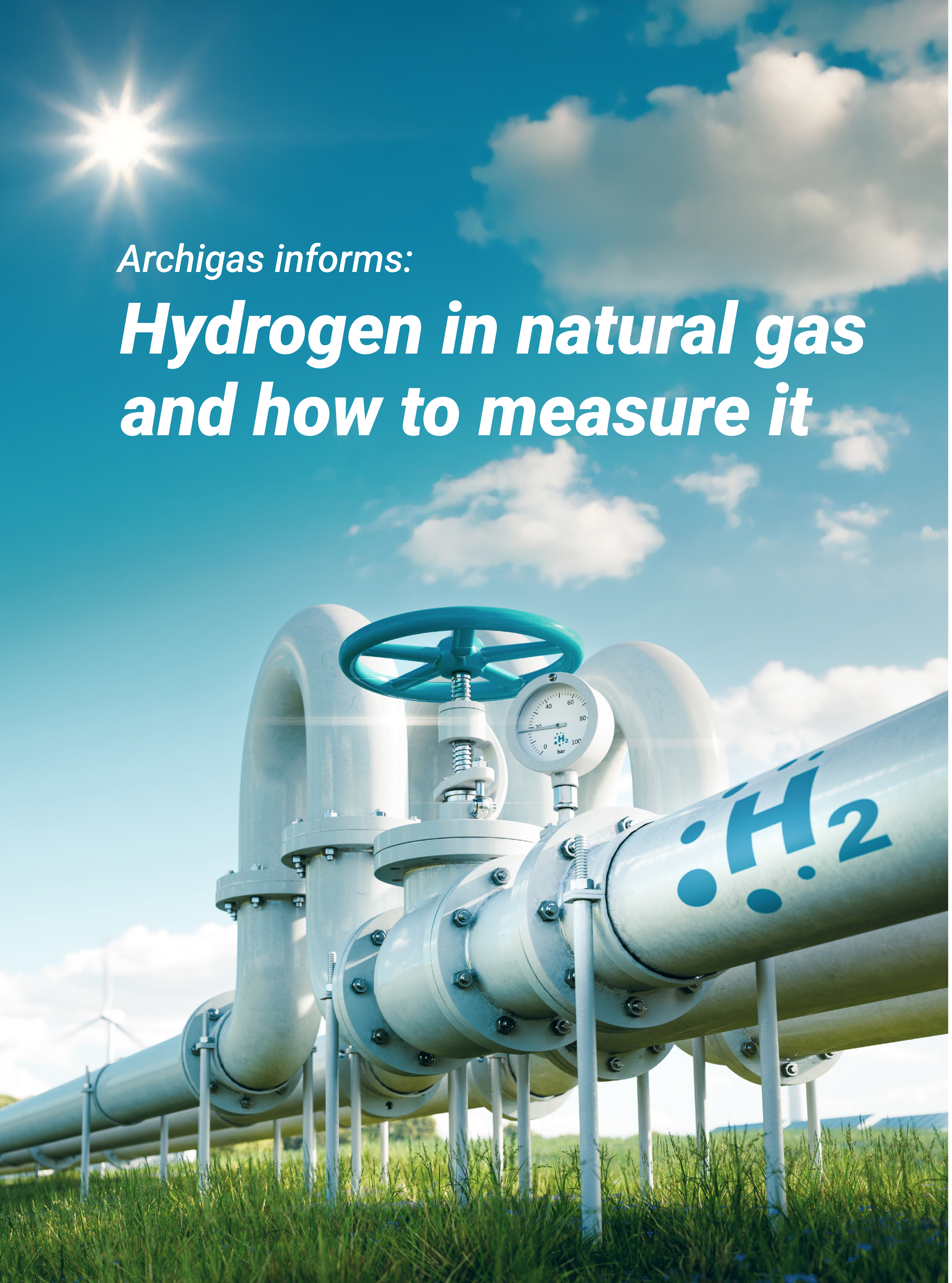
**DI Stefan Kolar, H₂i GreenHydrogen GmbH**

*“We use the TCD3000 Si from Archigas to determine the gas composition of the product gas in a test setup for zinc interstage electrolysis. The device is able to detect from 0-100% hydrogen content with high accuracy, which is absolutely essential for the application. We obtain a stable signal without any significant noise or drift. And even with high humidity and even condensing conditions in the sample gas, the sensor delivers a reproducible signal. Thanks to clear documentation and a well thought-out communication protocol, installation and commissioning are easy. Communication between the PC and sensor is stable. We would also like to use the device for a later application with high pressure. If we have any questions or queries for Archigas, they respond quickly and helpfully.”*

**Technische Universität Berlin, Chair of Powertrain Technologies**

*Archigas informs:*

# *Hydrogen in natural gas and how to measure it*

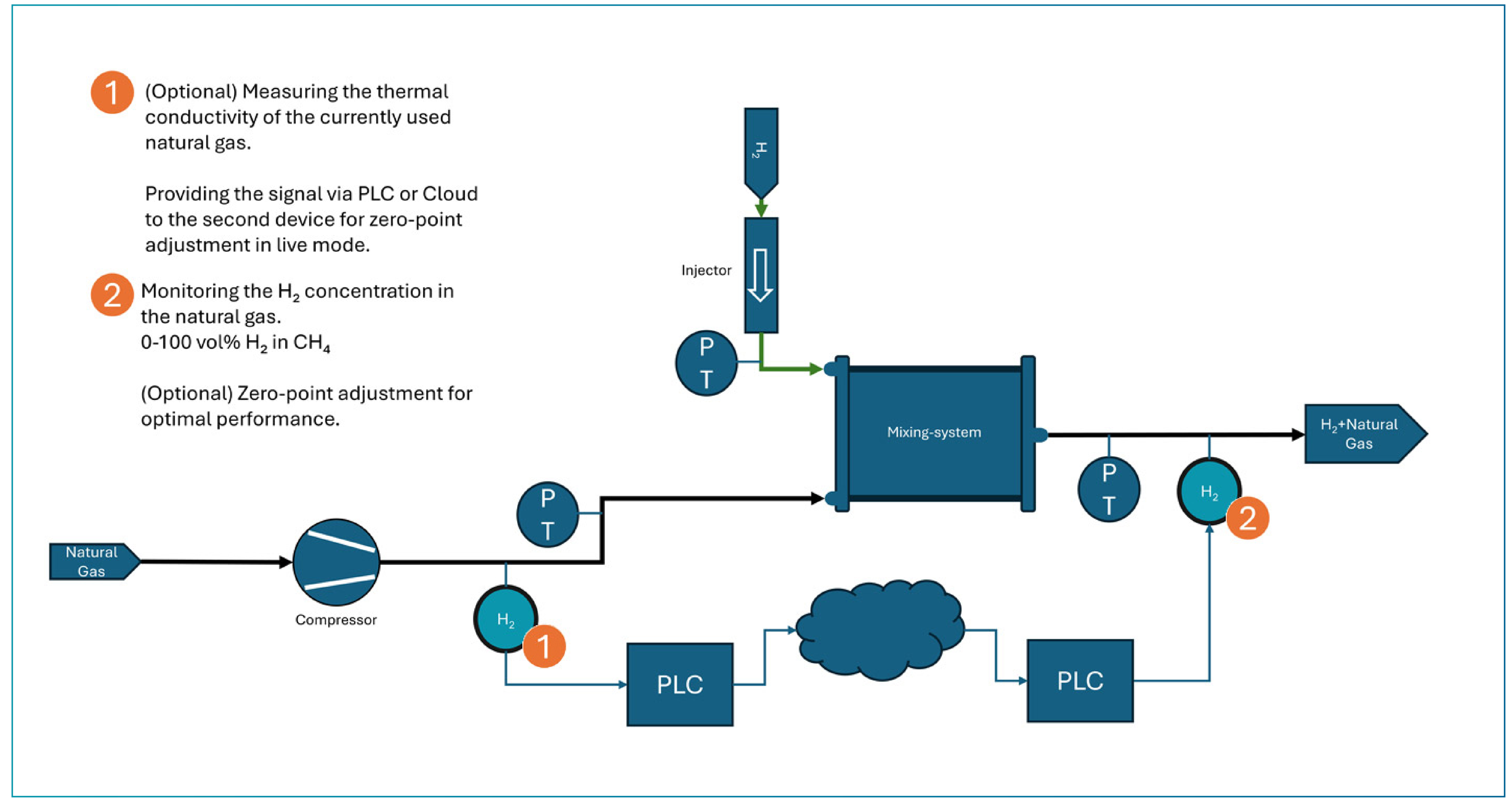



**The global trend towards a more sustainable energy supply and the associated pressure to reduce greenhouse gas emissions have significantly accelerated the transition from fossil fuels to $CO_2$-neutral energy sources. In this context, hydrogen is becoming increasingly important as a clean-burning energy source. In order to reduce $CO_2$ emissions, energy suppliers are implementing processes for blending $H_2$ into existing natural gas infrastructures. As is well known, pure hydrogen is added to the natural gas stream using special injection systems.**

As an increasing proportion of hydrogen is now being sought in the gas network - from moderate admixtures in the double-digit percentage range to completely hydrogen-based distribution networks – extensive studies have already been carried out in recent years on the suitability of the existing gas infrastructure. Although hydrogen and natural gas are both gaseous energy sources, they differ significantly in their physical and chemical properties. These differences relate in particular to the calorific value, density, $CO_2$ content and accompanying components such as water, oxygen and sulphur, which have a significant influence on the transport and usage properties. For Germany, for example, these studies have shown that it is possible to convert existing grids to transport hydrogen-natural gas mixtures or even pure hydrogen with comparatively little adaptation effort. The technical and structural prerequisites are therefore favorable.

And the incentive is great: after all, there are many reasons for integrating hydrogen into natural gas networks. First of all, there is the aforementioned reduction in $CO_2$ emissions, as the substitution of fossil fuels with hydrogen reduces the carbon content in the fuel and thus enables lower-emission combustion. In addition, the use of renewable electricity – for example from wind and photovoltaic systems – to generate hydrogen also allows these forms of energy to be efficiently stored and fed into the gas grid. This helps to increase energy efficiency, as hydrogen has a higher energy content per kilogram than natural gas. In industrial applications in particular, especially in high-temperature processes, the addition of hydrogen can increase energy efficiency and process performance. Gradual blending also supports the gradual transformation of the existing gas infrastructure towards a comprehensive hydrogen economy without the need for a complete system conversion in the short term.

The precise and timely measurement of the hydrogen concentration in the gas mixture is crucial for the increased development towards “$H_2$ in $CH_4$”. Because the quality of natural gas is subject to considerable fluctuations – due to both different origins and the increasing feed-in from power-to-gas plants – continuous monitoring is essential!




The composition of the gas ultimately has a significant influence on the calorific value, which not only serves as the basis for calculating the price, but also influences technical processes. In industry in particular, a change in gas quality, for example due to an increasing hydrogen content, can lead to deviations in the combustion temperature, which can have a negative impact on production processes such as glass melting.

Dynamic, accurate and reliable measurement solutions are therefore essential for the operation of mixing plants that feed hydrogen into natural gas in a range of 0 to 100 percent by volume. Detecting the $H_2$ concentration in the natural gas places high demands: Moisture and particles can affect the sensor technology, while fluctuating gas compositions falsify the measurement results. Safety-related aspects such as avoiding gas leaks and dealing with high pressures are also among the challenges.

Measurement based on the principle of thermal conductivity has proven to be particularly suitable. The thermal conductivity measurement utilizes the different thermal properties of hydrogen and methane. In binary mixtures – i.e. pure $H_2$-$CH_4$ systems – methane acts as a constant background gas, which allows a linear measurement signal and a very precise quantification of the hydrogen content.

If the background gas consists of several constant components, the system can also be calibrated so that an exact determination is also possible in more complex mixtures. However, difficulties arise when the composition of the background gas changes, as is common with natural gas. Fluctuations in the CO or $CO_2$ content can lead to measurement deviations, as the zero point of the measurement shifts. Dynamic zero point adjustment offers a solution here: by measuring the respective natural gas mixture without the addition of hydrogen in advance, a referenced zero value can be determined and transmitted to downstream devices, whereby the measurement is continuously adapted to the current gas composition.

A typical measurement setup involves first taking a measurement without $H_2$ in order to determine the zero point. Based on this, the hydrogen concentration in the enriched gas mixture is determined taking this dynamically adjusted zero point into account. This procedure ensures reliable and accurate hydrogen measurement even if the gas composition changes.

*Can also detect hydrogen in natural gas*

# Sensor solution from Archigas detects $H_2$ in $CH_4$ quickly and precisely

*Innovative measurement technology is recommended for further applications*

**New paths are opening up: The strategy of also using natural gas pipelines to transport hydrogen on a large scale opens up completely new planning opportunities for industry. The basic prerequisite for operating a mixing system to enrich a natural gas pipeline with hydrogen from 0 to 100 percent by volume is dynamic, precise and fast detection of the $H_2$ concentration. As great as the need for such measurements is, however, the selection of suitable product solutions is still limited. The gas analyzers from Archigas already excellently meet the special challenges of detecting $H_2$ in $CH_4$ thanks to a further developed form of thermal conductivity measurement. This is confirmed by user tests as well as a study by the Dutch research institute VSL*: According to the results, the award-winning gas analysis from Archigas can also demonstrate its advantages in this special area of application.**

There are many reasons for blending hydrogen into natural gas: For example, the carbon content of the fuel is reduced, which leads to lower $CO_2$ emissions – an important step towards achieving climate targets as well as reducing costly $CO_2$ levies. Energy efficiency can also be increased, as hydrogen significantly increases the calorific value of the gas, which is particularly important for high-temperature processes in certain industries. In addition, renewable energy can be integrated if $H_2$ is produced from surplus electricity generated from renewable energies and efficiently used and stored in natural gas networks. The addition of $H_2$ to $CH_4$ therefore makes a lot of sense in many respects, and consistent measurement of the concentration is absolutely essential. However, gas analysis faces particular challenges here: Moisture and particles threaten to damage conventional sensors, an unknown composition of the natural gas can lead to cross-influences, samples must not be allowed to enter the environment and high pressures damage measuring devices, to name just a few neuralgic aspects.

To enable effective, safe and reliable detection, a sensor solution is required that meets the special challenges. This is where Archigas‘ optimized WLD measurement technology comes in, which is also the basis for the recently introduced TCD3000 SiA gas analyzer in a screw-in version with ATEX certification from the supplier: The device measures in the range of 0-100 vol.%, is resistant to high humidity and particles, the precise calibration minimizes cross-influences and ensures high accuracy. In addition, the sample remains safely in the system and high reliability and durability are guaranteed thanks to pressure resistance up to 200 bar.

“The demand for options for measuring H2 in CH4 is enormous, as we know from urgent inquiries from interested parties in various countries. However, there are hardly any technical solutions to date, and certainly not any that measure in-line and are already available on the market. In the meantime, long-term practical applications, such as those carried out by a well-known customer and manufacturer of natural gas plants from Italy, prove that Archigas‘ gas analysis can also demonstrate its specific characteristics in this area of application,“ reports the managing director duo Wladimir Barskyi and Illya Kaufman.

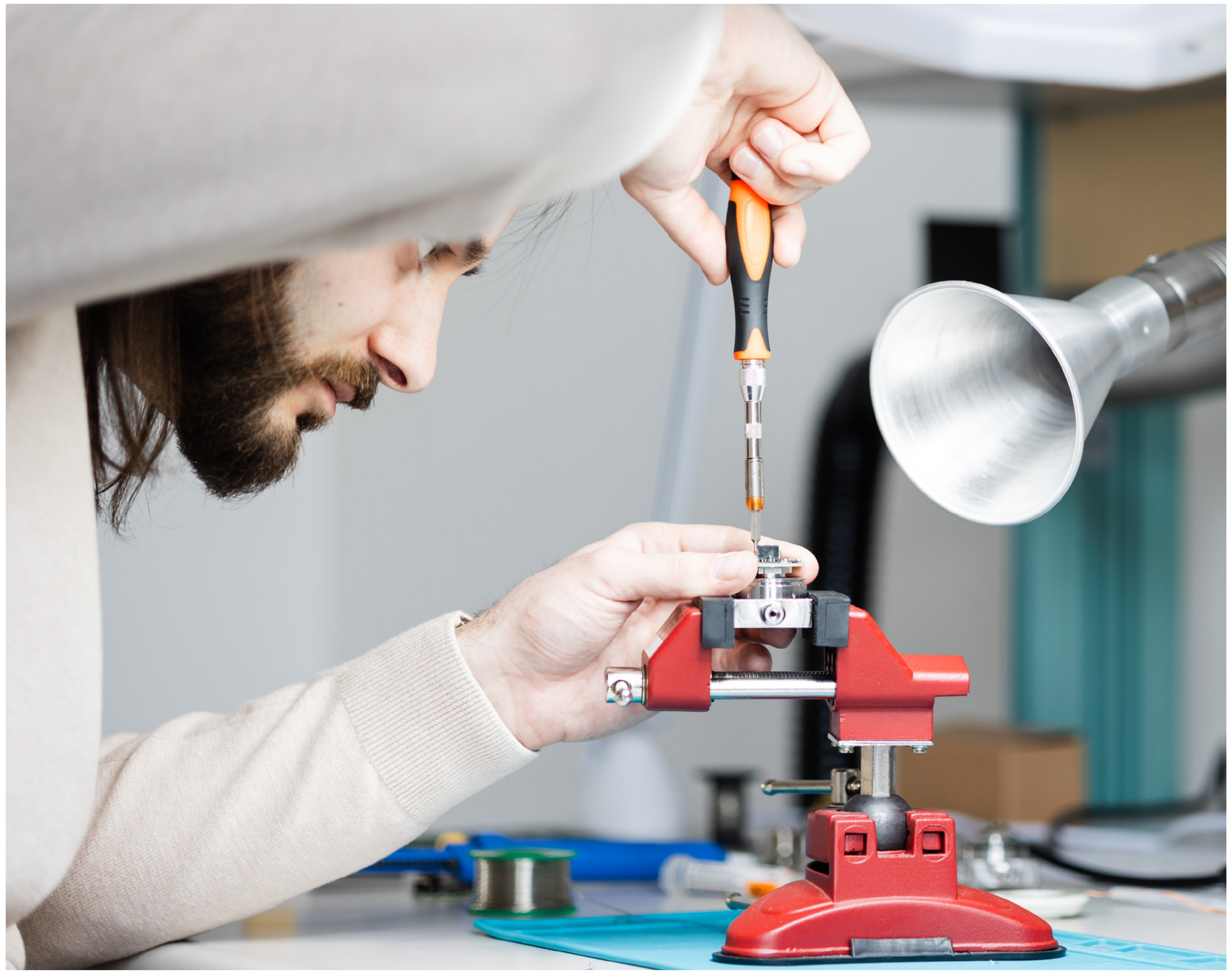
A comparative test* recently carried out by the renowned VSL Institute as part of an EMPIR decarbonization project also confirms the potential of the advanced WLD technology for the complex measurement of hydrogen in natural gas. “Here at Archigas, we naturally took a close look at the results of this study with regard to our device. From our point of view, the extraordinarily short response time should be emphasized once again: While the t95 time is specified in minutes for the other tested technology, the t95 value for our measuring device is within one second as soon as the gas reaches the device. This is basically live monitoring,” Barskyi comments on the results.

“In order to benefit optimally from the high measuring precision of our sensor solution in practice, it is of course advisable to calibrate it before use. In this test, our device was only tested uncalibrated due to the test design, which the testers also pointed out, and even under these conditions remained at a standard deviation of well below 10 % by volume – without calibration, mind you. With calibration, the precision is less than 1% of the measuring range, as we know from years of experience,” says Barskyi proudly.

With the findings from users in practice and the test results described, the innovative Archigas sensor technology has therefore been able to impressively prove itself in an additional important field of application – the detection of hydrogen in natural gas.

**Comparison of hydrogen enriched natural gas analysers – Evaluation report, VSL B.V., Data on file*

VSL



*Archigas steps on the gas on the sidelines of the 24-hour race*

# *$H_2$ sensor technology successfully tested at Le Mans!*

**Le Mans is more than just a car race. Le Mans is more than the iconic 24-hour competition between great drivers and car manufacturers. Le Mans is more than just one of the most important motorsport events. It is not just a place where cars overtake each other, it is a place where human ingenuity overtakes the present. Every year, the racing spectacle also becomes the ultimate high-tech practical laboratory, where techno-logical solutions are tested that could shape nothing less than the future of our mobility. On the sidelines of this year‘s edition, Archigas tested its innovative measurement sensor technology in the Hydrogen Village on the track – for ultra-fast, precise and reliable $H_2$ detection. With success: the tests were convincing across the board.**

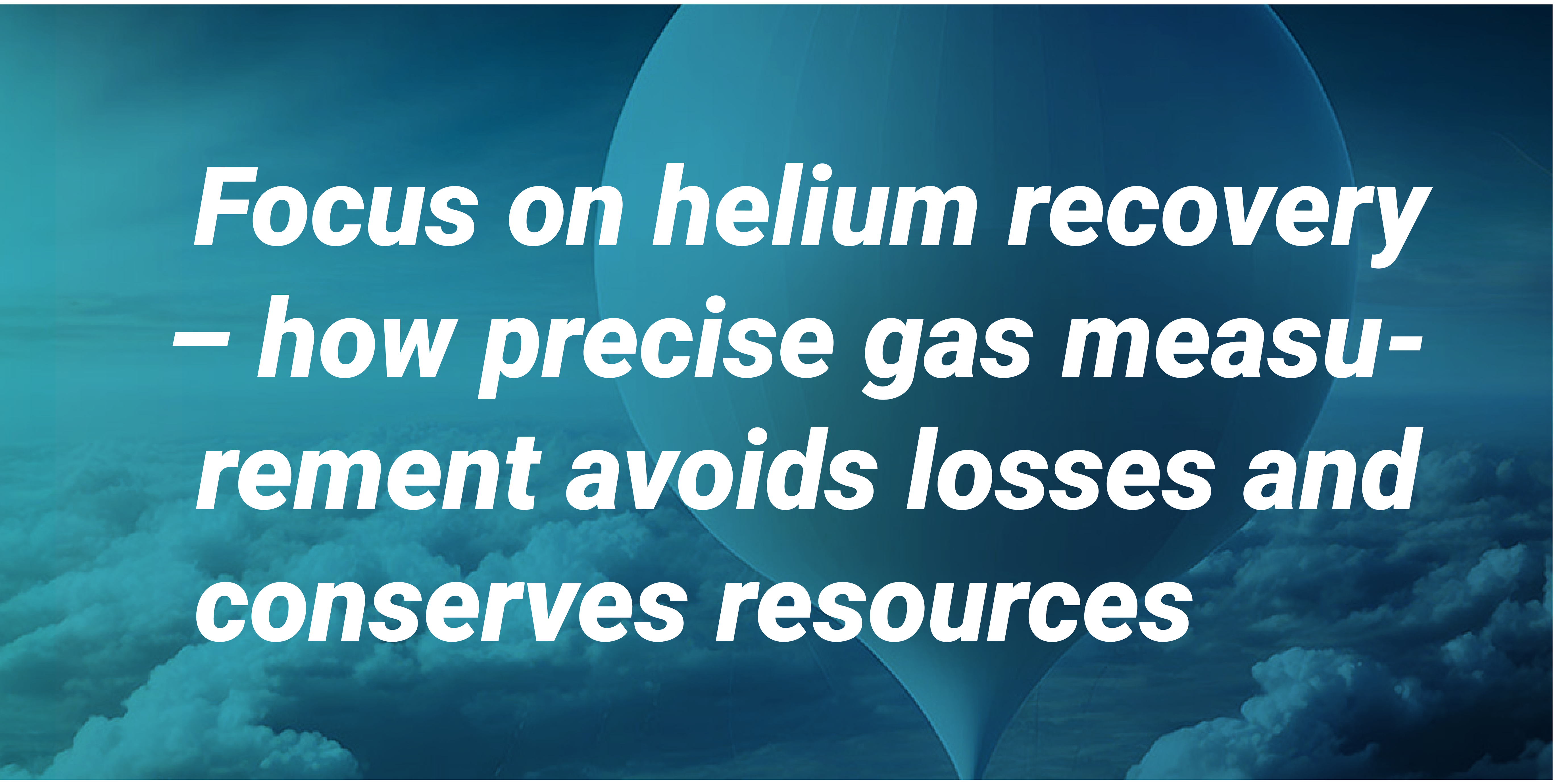

*"The environment at Le Mans this year gave us the perfect opportunity to test the Archigas sensors. The tests were very successful: The measurements were fast and accurate – they were exactly what we were looking for."*

**Mathieu Walter, $H_2$ motorsport expert**

Hydrogen is highly flammable, and what is flammable generates energy. Energy, in turn, is required to get from A to B. But energy must be controlled. Hardly any other technical field – perhaps even rocketry – knows this as well as motor racing. Here, the systems are exposed to particularly extreme requirements: If these are not met, there is a risk of technical failure or even worse. The solutions must therefore be efficient and safe, and this also applies in particular to the use of hydrogen as an energy source. The goal is worthwhile: an $H_2$ drive is ultimately predestined to reduce climate-damaging $CO_2$ emissions.

So if it passes in motorsport, it has passed its baptism of fire for everyday use in road traffic. Since its initial presentation around three years ago, Archigas' unique sensor technology has already proven itself worldwide in electrolysis, fuel cells, $H_2$ in natural gas and other fields of application. Now the system has been put to the test for racing. The speed and precision of the measurements were closely monitored and evaluated. "The signals were virtually in real time on the monitor, the values were exact and the measurement was absolutely stable," Archigas product engineer Tom Burkard was pleased to report during the test in the hydrogen area of the track in Le Mans. The sensor detected the supplied hydrogen immediately, even with high $H_2$ dilution in the air. Screwed directly into the line via an aluminum block, the exact hydrogen content to be expected was also determined just as quickly. "The device worked excellently in both test variants," says Burkard. The management of Archigas, who were unable to be at the track themselves due to scheduling conflicts, were also vindicated. "In racing, people are particularly interested in speed, in our case the reaction speed of the sensor. At 30 milliseconds, we are literally in the Pole Position," said Illya Kaufman and Wladimir Barskyi from the headquarters in Rüsselsheim.

The assessment by Mathieu Walter, $H_2$ technology expert with many years of motorsport expertise, who commissioned and supervised the tests on site, is particularly important. For him, safety is the top priority when using hydrogen, which in turn requires fast and precise detection. "The environment in Le Mans offered us the ideal opportunity for testing, and the tests were successful. The measurements were fast and accurate – they were exactly what we were looking for," he concludes positively.



# Focus on helium recovery – how precise gas measurement avoids losses and conserves resources

**In times of increasing resource scarcity, one topic is increasingly becoming the focus of industrial attention: the recovery of helium.**

This noble gas is irreplaceable in numerous high-tech applications due to its unique physical properties – it is light, inert, non-flammable and extremely volatile. Whether in magnetic resonance imaging, cryogenic cooling systems or semiconductor production – helium is used wherever stability, thermal conductivity and extremely low temperatures are required. But there is one problem: helium is not renewable. It is produced in geological decay processes over millions of years, while global reserves are finite – and demand is rising.

Against this backdrop, helium recovery, i.e. the recovery of gas from technical processes, is becoming increasingly important. In modern systems, attempts are made not to simply allow the uncontaminated helium to escape after use, but to recover, process and reuse it. This recycling process not only conserves natural resources, but also significantly reduces operating costs - especially in applications with a high helium throughput. However, as simple as the principle sounds, the technical implementation is challenging. A key aspect of helium recovery is precise gas analysis. In order to recover helium, you need to know exactly where it is located, in what concentration it is present and when the recovery process can be initiated efficiently. This is where an often underestimated problem arises: in many systems, gas analysis is still carried out using conventional sampling methods, in which part of the gas is taken from the line and fed to an external analyzer. With a gas as diffusible and volatile as helium, however, this often means that a significant proportion is inevitably lost – either through leaks in the sampling system or through escape during transfer. Particularly in continuous processes, these losses add up to considerable sums over the year, often in the five-digit euro range.

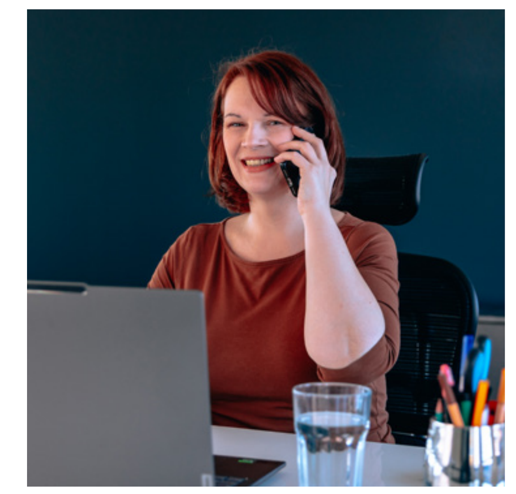
A modern solution therefore relies on closed, direct measurement methods – so-called in-line or in-situ measurements. Here, the gas is continuously monitored within the closed system without the need to remove it from the environment. The advantage is obvious: no helium is lost, the process remains stable and the measurement results are available in real time. The quality of the sensor technology is crucial. Only a highly sensitive, long-term stable measuring system can reliably detect the typical concentration fluctuations that occur, for example, during recirculation from vacuum chambers, rinsing processes or cryogenic applications.

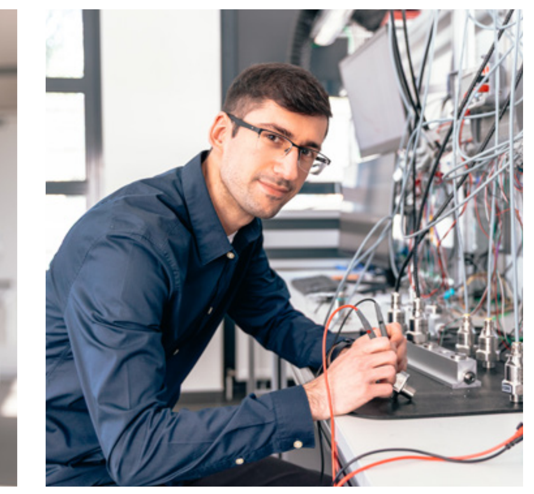
A further technical requirement results from the low density and thermal conductivity of helium, which requires particularly sensitive detection. Modern analyzers use specialized principles for this, such as measuring the thermal conductivity of the gas, as this is particularly pronounced with helium. With appropriate calibration and suitable signal processing, even the smallest helium concentrations can be precisely detected - without measurement drift or unwanted gas loss. In the long term, therefore, it is not only the will to recover that determines the success of a recovery system, but also the technical quality of the measurement technology. The full potential of helium recycling can only be exploited – both ecologically and economically – if the monitoring is loss-free, reliable and with high resolution.

If you are interested in precise helium measurement and solutions for loss-free gas analysis, visit our homepage www.archigas.com or write to us directly: info@archigas.com

# Archigas news compact


+ + + Both at the **Hannover Messe** in April and in Rotterdam as part of the **World Hydrogen 2025 Summit & Exhibition** in May, we took part in a real consultation marathon including live tests. Wladimir, Max, Jacqui and Thomas provided information about our gas analysis solutions such as the screw-in ultra-compact gas analyzer TCD3000 SiA with Atex certification. The interest was huge again – and it continues to grow. In addition to $H_2$ measurement, additional application areas such as helium detection were often requested. Further event participations this year – both nationally and internationally – are already being planned and we will keep you up to date.




+ + + Due to the great popularity, it is important that we also keep pace in terms of personnel and have **more highly competent and highly motivated staff** on board. With Maximilian, Tess, Natalia, Arpiar and Suman, we have not only been able to recruit extremely capable but also extremely pleasant new employees in recent months. Whether **Max** with **Tess** in sales, **Natalia** as an automation expert or **Arpiar** and **Suman** to support the development and production department: they are all committed – just like the whole Archigas team – to providing you with the best possible support in all matters.

+ + + Another "accolade" for Archigas: our measurement technology was once again honored with an explicit **mention in the renowned scientific journal "Nature".** As part of an article on high-pressure water electrolysis with AEMs: „The hydrogen concentration was measured with an TCD3000 sensor from Archigas, which was applied next to the pressure sensor of the $O_2$ loop. It can measure $H_2$-quantity's from 10ppm exact."

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