SICK insight MAGAZINE

: FOCUS **CLEAN PROCESSES**

CLEAN PROCESSES

RESOURCE-EFFICIENT PRODUCTION

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TIME FOR CLEANER SOLUTIONS

Dear Readers,

Against a backdrop of steadily depleting raw materials, industry is faced with the challenge of producing and processing goods in a way that uses resources as efficiently as possible. Process parameters must be measured and monitored continuously in order to ensure optimized industrial processes that maintain a clean environment offering a high quality of life. On top of this, failures and faults in the process sequence have to be prevented.

By using precise, reliable sensors and systems from SICK for analysis and process measurement technology, facility operators can achieve maximum measurement accuracy and safety in every area of process monitoring – whether they have statutory or official requirements to meet for compliance with emission and pollutant limits or they wish to monitor, document, or optimize the function and efficiency of their facility. We have a team of experts across the globe on hand to help. They not only provide support for implementation, but also assist in the process of reducing maintenance outlay and overall costs.

As a provider of turnkey emission measurement solutions, SICK is responsible for the development of innovative technology and measurement principles that have proven themselves over the decades, even in the face of ever-increasing environmental and safety requirements. Furthermore, our reliable sensors, analyzers, and measuring instruments help wind power, solar, and biogas plants to operate efficiently and optimize the production of renewable energy. SICK therefore plays a key role in the efforts to keep our air and our environment as clean as possible.

We hope you find this issue informative.

Markus Vatter
Member of the Executive Board of SICK AG

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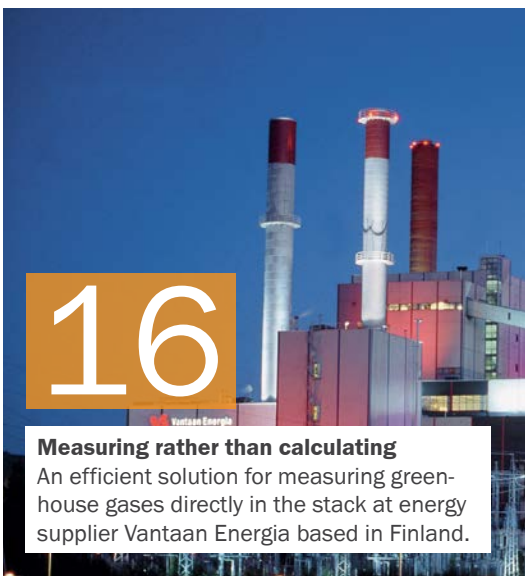
Efficient process management
LFP Cubic and LFP Inox TDR level sensors: a solution for any application in any environment.



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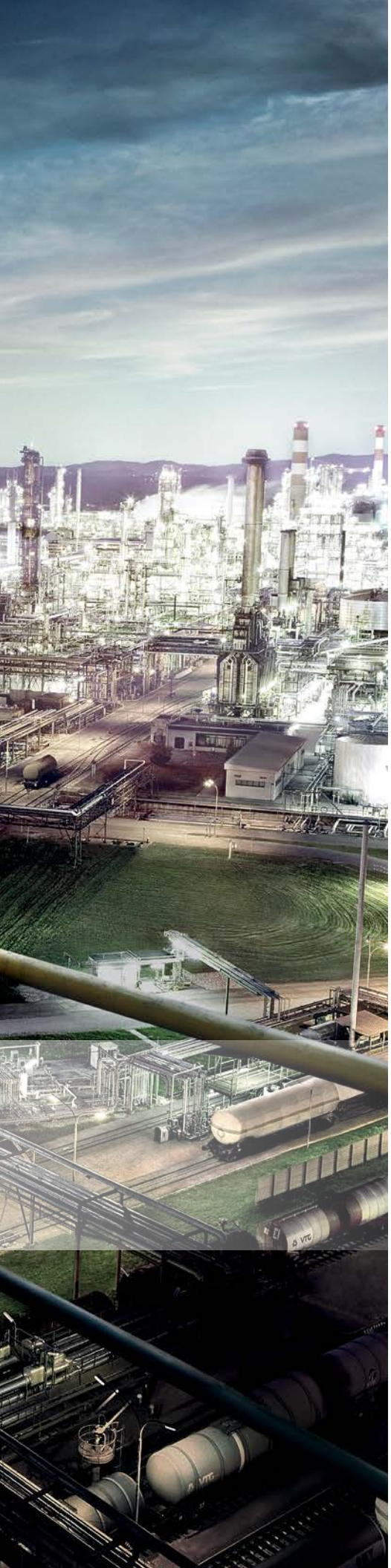
MONITORING IS GOOD, UNDERSTANDING IS BETTER



"Industry 4.0" is a major new trend in the area of process automation. Real-time data provides companies with a stronger basis for predicting problems in advance, streamlining processes where they need it most, and reducing maintenance work. The result? Facilities are safer, better for the environment, and more efficient. In reality however, continuous process measurement technology is often seen as nothing more than a means for protecting the operators. Otherwise, they are not really discussed until the company is under pressure to cut costs. In fact, continuous systems can play a surprisingly important role in the cost cutting process right from the outset.

>> For this to be successful, analytical system providers have to do more for their customers. They have to take a more in-depth look at the processes used by facility operators. After all, even the most sophisticated analyzers are not much use if the sample preparation system has not been designed properly. However, design problems are not easy to spot: "Problems with measurement data are seldom caused by the measurement device itself. In 80% of cases, these problems are actually caused by the way the analysis system has been designed" explains Dr. Norbert Zeug, Strategic Industry Manager Chemical & HPI at SICK, who has over 30 years of industry experience.

While their teams are getting smaller, measurement and control technology departments are finding themselves faced with a wide spectrum of automation tasks. This in turn leads to an increasing number of specialist tasks being outsourced. This is where SICK with its valuable knowledge comes in – advising and supporting its customers with great reliability. There are often hundreds of possible processes, some of which vary greatly from the next. In turn, these processes can then use a variety of different measurement principles and devices, each produced by one of hundreds of manufacturers. Only a company that truly understands the operator's processes, needs, and objectives can design a turnkey solution for maximum benefit.

However, a few hurdles still have to be overcome before efficient solutions can be implemented. Dr. Zeug explains "Companies often keep the areas of requirements and selection separate. They therefore risk defining objectives or criteria that are too stringent and lead to them focusing their efforts in the wrong places. Design-related errors can also occur by applying criteria that are not relevant to the problem."

SICK believes in taking an honest, practical, and comprehensive approach to the task at hand. Customers benefit from the expertise that SICK's experienced employees gained from decades of development work and practice in hundreds of process analysis installations all over the world.

Furthermore, SICK has an extensive portfolio of analyzers, turnkey systems, and services for universal use. In fact, when it comes to emission measurement systems, SICK is the only company in the world that offers full turnkey solutions. By providing cutting-edge controls, interfaces, and field bus systems, SICK is preparing for "Industry 4.0." This vision for the future imagines a system where machines, sensors, analyzers, and operating staff are all linked to commercial systems and Internet services.

"Problems with measurement data are seldom caused by the measurement device itself. In 80% of cases, these problems are actually caused by the way the analysis system has been designed."

Dr. Norbert Zeug, Strategic Industry Manager Chemical & HPI, SICK AG

Process analytics that pay off

The manager of a petrochemical refinery was required to adhere to certain CO limits for the production of hydrogen in order to ensure that the downstream catalytic reactor could be used correctly. As he felt certain that he was adhering to these values, he decided not to use additional analysis technology with a warning function. However, the limits were in fact exceeded so that the catalytic reactor was out of use on two subsequent occasions. This resulted in several million dollars worth of damage. This example is proof of how using process analytics in the right place not only makes sense but could also save money.

Also available with a design adapted for explosion-risk areas: the extractive gas analyzer EuroFID3010

Safe operation thanks to adjustment of alarm thresholds

A chemicals plant in Asia is installing a new waste gas combustion system. The dangerous blend of substances extracted from the systems are fed into the thermal waste gas combustion system. The concentration must not exceed the lower explosive limit (LEL) during this process. The initial specified accuracy of +/–0.1% would have required the plant to carry out complicated intermittent measurements. As a result, it would have been unable to complete the actual measurement task required, i.e., ensuring that an alarm is issued quickly if the LEL is exceeded. After analyzing the plant's requirements, SICK convinced the customer to go for a more practical solution that used an FID analyzer for continuous measurement. A subsequent calculation of the specified waste gas components revealed the value for safe operation below the explosive limit. Safe operation was then guaranteed by adjusting the alarm thresholds accordingly. The plant now no longer risks exceeding the explosive limit.

Hot extractive systems provide added benefits

When using conventional cold extractive analysis systems, nitric acid plants are often afflicted by the build-up of ammonium salt between the DeNOX reactor and the analyzer. This results in increased maintenance work for the plant and means that systems are often unavailable. As the salting problems would have been particularly extreme at the start of the sampling process with a cold extractive system, SICK recommended the facility operator to use a universal hot extractive system instead. This would prevent the build-up of salt and also provide reliable measurements for both nitrogen oxide and ammonia slip. However, the selection options only included cold extractive systems as the operator was unaware that hot systems could be used for the situation in question. In the end, SICK managed to win over the customer with its suggested solution.

An impressive solution: hot extractive system for use in nitric acid plants

A minor cause, a major impact and comprehensive advisory services

A state-of-the-art exhaust gas measurement system was installed in a combustion system. However, the operator did not specify that the system was also used to burn silane. As a result, tiny particles of silicon oxides collected on the filter within a short space of time, putting the analyzer out of operation. The plant management no longer received information on measured values. The problem was not uncovered until all the various departments attended a meeting together. SICK then quickly developed its own simple “trap” for silicon oxide particles. This example shows that one cannot always rely on routine procedures. In-depth research and integrated communication channels are needed to ensure that every single relevant process parameter can be identified.

A special solution for fertilizer production: FWE200 with integrated purging system

SICK Metering Systems

SICK Metering Systems is based in Kalmthout, Belgium, and is a joint venture between SICK Engineering GmbH and Global Gas Solutions BV. This cooperative venture focuses on complex system solutions for gas measurement stations, so-called Integrated Metering Solutions. In addition to measurement systems, their solutions include filter and pressure regulation stations, heating units and boilers, measuring points and interfaces for key systems, plus evaluation and monitoring software. This partnership has enabled SICK to consolidate its expertise in the area of products and projects for ultrasonic flow measurement technology for the natural gas industry. This expertise is now also combined with the knowledge and service network provided by Global Gas Solutions BV, a system integrator specializing in gas and liquid metering technology founded back in 2006.

Dust measurement solution devised for fertilizer production

The prilling machine at a fertilizer production plant emits both ammonia and moist ammonium nitrate dust as waste. Typical in-situ dust measuring devices are not suitable for this purpose. The extractive scattered light dust measuring device FWE200 by SICK on the other hand is ideal: an ejection pump draws the moist particles into the device's heated cyclone where the water is then vaporized. Once dried, the particles are analyzed in the measurement cell and blown back into the process by the ejector. However, the highly hygroscopic salts common in fertilizer plants led to large deposits within the measurement system. SICK quickly added an integrated rinsing solution to the FWE200 and succeeded in finding an innovative solution for the fertilizer industry along the way. *(sr)*

LEVEL MEASUREMENT WITH LFP Cubic AND LFP Inox

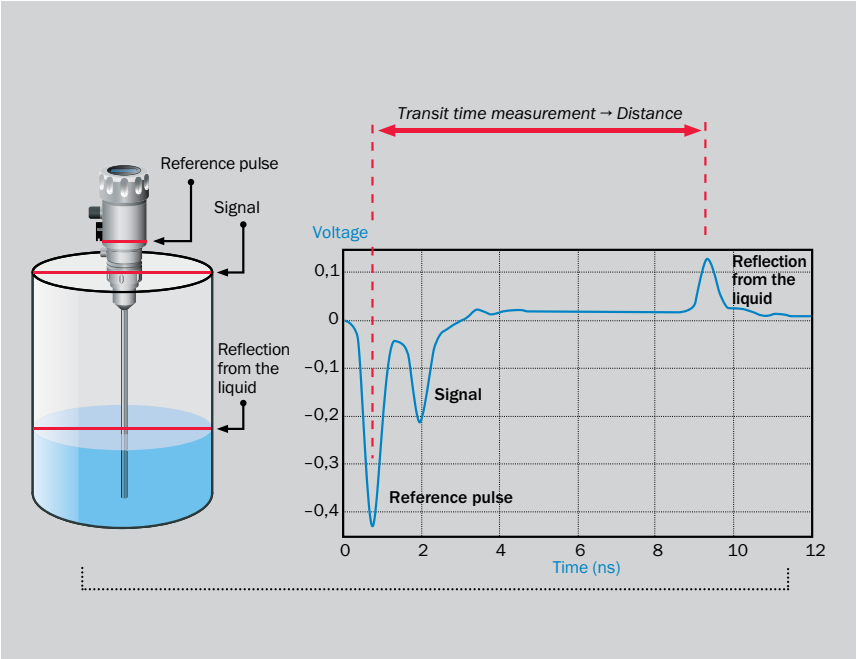
EFFICIENT PROCESS MANAGEMENT – RIGHT FROM THE OUTSET

Measuring levels is a key task in process control: a task that is carried out in a wide variety of areas. This process requires operators to consider both the substance to be measured and the measurement environment. And these are not the only factors to be considered: the installation situation and container size can also have an impact. However, this is easy for anyone who can rely on a diverse technology portfolio and expert knowledge in integrating sensors into entire plant systems. With its LFP Cubic and LFP Inox TDR level sensors, SICK offers suitable solutions for any application, in any environment.

>> Precise, reliable, and as efficient as possible: the same principles apply to level measurement processes as they do to other sub-processes in production. A selection of suitable technology at as early a stage as possible helps to keep inefficient processes and wasted resources to a minimum.

The benefits of TDR technology: “guided microwaves”

When measuring liquids, the results can be affected by the various levels of the medium's conductivity, density, and viscosity. Furthermore, operators have to be aware of the build-up of deposits, chemical stability, and any moving parts in the tank (e.g., mixers or stirring units) that may affect the results. The LFP Cubic and LFP Inox level sensors from SICK apply the “guided microwave” measurement principle (TDR: time domain reflectometry). The sensor's electronics system generates an electromagnetic impulse (reference pulse). This pulse is guided along the probe, normally a metal rod or steel wire, from the entrance to the tank (signal) to the surface of the medium to be tested. Part of the impulse is reflected off the surface and sent back along the probe into the sensor's electronics system. The difference in the time from the signal being transmitted and then received again is used to calculate the level, taking into the account the dielectric constant for the medium in question. Depending on the operator's requirements, the sensor can either emit the calculated level as an analog value (“continuous measurement”) or as several switch signals (“point level measurement”). One of the other major benefits of this technology is that factors like pressure, temperature, vacuum, dust, and in particular foaming do not have a significant impact on the measurement result.



Measurement principle for TDR technology

A flexible, low-cost solution

In the past, TDR technology was often seen as a rather complicated and costly process. However, it has recently established itself as a more cost-effective and attractive option for less complex measuring applications. With the LFP Cubic, SICK offers customers a flexible and low-cost solution that is ideal for use in metal containers and tanks in the water industry, mechanical engineering, machine tool, plant construction, and building technology. The LFP Cubic also offers customers a great deal of flexibility thanks to its modular probe concept that enables it to be used with either a rigid probe, coaxial tube, flexible probe, or as a compact variant without a probe.

An LFP Cubic sensor with a coaxial tube monitors the level of lubricant and hydraulic oil in a CNC machine

Reliable, even in foamy substances: the LFP Inox in action in a round bottle-filling machine

A clean solution

Like the LFP Cubic, the LFP Inox delivers continuous measurement or point level measurement according to requirements in a single system; this too cuts costs significantly. The LFP Inox is ideally equipped for use in hygiene-related processes as the sensor is certified under both EHEDG and 3-A, while the materials used comply with the requirements issued by the FDA. Its temperature stability and pressure resistance also mean that there is nothing preventing the sensor from being used in CIP and SIP processes, in areas such as the food and beverages industries. The housing and design have also been carefully thought out. With IP 67 and IP 69K enclosure ratings, the sensor can even withstand more intensive cleaning processes using high-pressure cleaners. On request, LFP Cubic and LFP Inox sensors can also be PWIS-cleaned and then packed up safely for delivery. Special plasma cleaning processes are used for this purpose. Since the electronics are remote, the probe can also easily be sterilized in an autoclave – a typical requirement in the pharmaceuticals industry.

The benefits of a remote amplifier version

The remote amplifier version of both the LFP Inox and the LFP Cubic has a number of other benefits: it increases flexibility and saves space for installation, which is particularly useful when you are short on space.

This offers huge advantages for use in high tanks in particular. Since the electronics can be installed separately from the probe (at eye level, for example), both status and measurement result are always easy to read. Changes can also be made to sensor settings and parameters with ease. This solution also protects the electronics unit from heat generated from use, enabling the probe to be used at high temperatures.

Thanks to their ability to detect and ignore foam, LFP Inox and LFP Cubic sensors always provide precise measurement results, even in liquid with high levels of foaming and film build-up

LFP INOX OR LFP CUBIC: ALWAYS SUITED TO THE TASK AT HAND

	LFP Inox 	LFP Cubic 
Hygiene-related tasks (the sensors are CIP and SIP compatible)	✓	
Tasks involving foams	✓	✓
Rigid probe up to 2 m long	✓	✓
Rigid probe up to 4 m long	✓	
Flexible probe up to 4 m long		✓
Remote electronics case	✓	✓
Analog output with 2 switching outputs	✓	✓
Analog output with 4 switching outputs		✓
Approval under WHG (the German Water Act)	✓	
IO-Link communication	✓	✓
Compact variant (no probe)		✓
Titanium process connection (no probe)		✓

From EHEDG to WHG

Sensors that are easy to commission, maintenance-free, and almost entirely independent of the properties of the medium to be measured (meaning that the sensors in the LFP range do not have to be recalibrated) pave the way for significant savings in terms of both time and money. In doing so, they also make an important contribution to another objective: increasing process efficiency. The reliability and strength of the measurement result play a vital role here, while also taking industry-specific requirements into account. The food industry, for instance, is often subject to constructive regulations when it comes to the cleaning and sterilization of the components in use. These regulations are issued by bodies such as the European Hygienic Engineering Design Group (EHEDG) or the American 3-A Sanitary Standards. Some applications also require devices to receive legal approval, which cannot be issued until the level sensors have been tested and certified. Legal directives such as the German Federal Water Act (WHG) or corresponding EU directives govern the treatment of substances that could be harmful to water. Companies that operate facilities to store, fill, or empty such substances are required to prove that their equipment is protected against overflowing. *(tm)*

Level measurement in breweries and dairies: read the full report at **www.sickinsight.com**

Level and temperature monitoring in transformer stations: read the full report at **www.sickinsight.com**

Pressure, temperature, and flow

As well as measuring levels, parameters such as pressure, temperature, and flow also have to be monitored if one wants to increase efficiency and conserve resources. SICK provides a wide range of solutions for process control, stock supply, or the monitoring of liquids, gases, and bulk materials. In doing so, SICK places an emphasis on rugged sensors which measure as many of the particular measurands as possible, regardless of the environmental conditions.

More information: **www.sick.com/fluidsensors**

BUBBLING AND BREWING

A total of 52 dip tanks with 80 stopping points along a 27 meter long line equipped with three automatic carriages. These are the key facts for the new, cutting-edge GALVABAU AG electroplating system that has been running at the circuit board specialist Varioprint AG in Heiden, Switzerland, since 2013. The fully automated concept also features sensor solutions by SICK: UP56 ultrasonic sensors for level measurement and C4000 safety light curtains for area protection.

>> Chemistry plays a crucial role in the electroplating process: the tanks contain a mixture of water and additives which must be in perfect proportion with one another. Furthermore, these mixtures must not exceed or fall below certain levels in the tanks. “For level sensors that detect evaporation losses and leaks in the tanks, and monitor the medium supply, bubbling and spattering media create a really tough environment to work in”, says Patrick Risi, Product Manager at SICK's Stans site in Switzerland. “Thanks to the UP56, we were able to provide GALVABAU AG with a rugged, reliable solution that has none of the disadvantages associated with ordinary float switches or capacitance probes.”

As well as providing accurate measurements, ultrasonic level sensors are also distinguished by their ability to withstand a range of aggressive media. The corrosion resistant stainless steel housing has been issued an IP 67 enclosure rating. The transducer is protected by a Teflon coating. Application of the sensors in practice proves just how rugged they are: “The UP56's measurements and notifications are reliable and error-free” confirms Christoph Hutter, head of technical services and senior manager at Varioprint AG. “The level measurement values at the individual dip tanks are displayed on the control system's visualization screen. If the level is too low,

the medium in question is automatically refilled to the right level." GALVABAU's Managing Director Markus Gisler also has high praise for the number of sensor parameters that can be configured when commissioning the electroplating system: "We can switch the analog signal and adjust the switching signal limits using the integrated operator display, a PC, or even Connect+."

No collisions on the way to the electroplating line

A total of three carriages are responsible for transportation at the fully-automated electroplating plant. They transport three to six circuit boards to the dip tanks at a time and then return them again once the electroplating process is complete. To prevent the carriages from colliding with other objects or people in the plant, vertical C4000 safety light curtains monitor the carriages' paths. Classified as Performance Level PL e according to EN ISO 13849 and Type 4 according to IEC 61496, these sensors meet the very highest standards of protection. The main benefits for Varioprint AG are the system's sensing range of seven meters, the ability to cascade the systems over the entire length of the facility, and the beam coding feature, which prevents the sensors from interfering with one another during operation. If anyone breaches the protective field, the C4000 safety light curtains stop the carriages in their tracks instantly. *(kl)*

How does the electroplating process work?

The electroplating process involves a current being sent through an electrolyte bath. The metal (e.g., copper or nickel) to be applied to the object in question is connected to the positive terminal (anode), while the object to be coated is connected to the negative terminal, the cathode. The electric current causes the metal ions to be detached from the anode. These ions are then reduced and collect on the workpiece. This creates an even coating of copper (or any other metal) on all surfaces of the object in question. Increasing the time for which the object is immersed in the bath and the strength of the electrical current also increases the strength of the metallic coating.

BULKSCAN® LMS511 LASER VOLUME FLOWMETER

ACCURACY WITH NO IFS OR BUTS

Those looking to measure quantities of bulk materials on belts can now opt for a precise measuring process in the form of the Bulkscan® LMS511. Up until now traditional belt scales have always been used. These are simple and cost-effective, but they do have their pitfalls. Operators tend to experience problems when it comes to the accuracy of the weight measurement. The low level of measurement stability and the sensitivity of these devices, particularly in harsh conditions, also interfere with the production process. This process is a lot easier if the system can monitor mass flow as well as volume flow. This requires non-contact laser technology to be installed in rugged hardware suitable for outdoor use.

>> Anyone who uses conveyor systems in their working environment knows how important it is to have optimal control of the belts in each individual process step. The objects on the belt must not exceed or fall below the targets set for both quantity or level. Incorrect measurements must be avoided, otherwise the machines and belts could be so badly damaged that production comes to a complete stop. Considering that traditional belt scales are both inaccurate and susceptible to faults and then taking into account the costs for maintenance and repair, laser measurement technology seems like a very attractive alternative.

Volume, level, and center of gravity

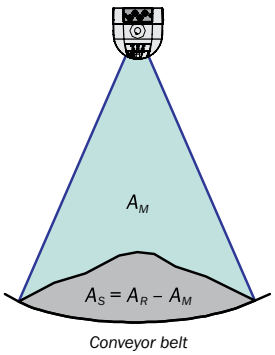
The Bulkscan® LMS511 measures volume flow continuously in a non-contact process and also identifies the fill level

and the center of gravity of bulk materials on belts. And thanks to multi-echo technology, it always works regardless of the weather (rain, snow, fog, dust) or the composition of the material at hand. Not even reflections in glass can disrupt the laser volume flowmeter. The laser beam detects the height profile of the bulk materials as well as volume and throughput, at sensing ranges of up to 20 meters. For instance, stones of an excessive size can be detected in good time, before they are able to block downstream system components. Using the integrated center of gravity calculation, the scanner monitors the belt load over the complete conveying line and recognizes one-sided loads or one-sided belt loads. It can even detect movements in the belt at an early stage, helping to make sure that the belt does not suffer high levels of wear and tear.

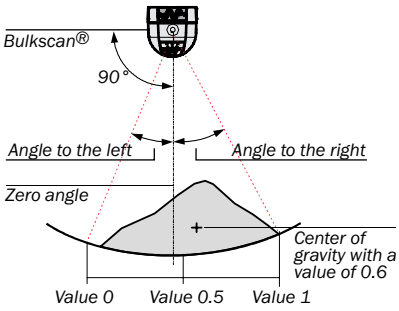
System shutdown in mines is now a thing of the past:
China Huadian Corp. invests in the Bulkscan® LMS511.
Read the full report at
www.sickinsight.com

Minimum maintenance, maximum cost-effectiveness

The special housing design ensures that the Bulkscan® LMS511 is rugged enough for outdoor use. It is installed above the belt, preventing it from being contaminated by the bulk materials. Furthermore, the measurement process is not affected by horizontal forces from the belt's rollers or plates. Functions for self-monitoring and auto-calibration increase the system availability; for instance, integrated sensors check the transparency of the front screen of the Bulkscan® LMS511 and generate an alarm signal if the value falls below an adjustable threshold. This function also reduces the maintenance work. The scanner reports automatically when cleaning is due. These devices can conduct measurements with the utmost operational safety, even in Siberian temperatures. An integrated heating system switches on at +5 °C and provides heat, even at temperatures as low as -30 °C. Even if a worst case scenario should occur, the system can be quickly put back into action. Finally, the modular concept ensures optimized spare part logistics and quick and straightforward replacement of the components concerned. *(tm)*



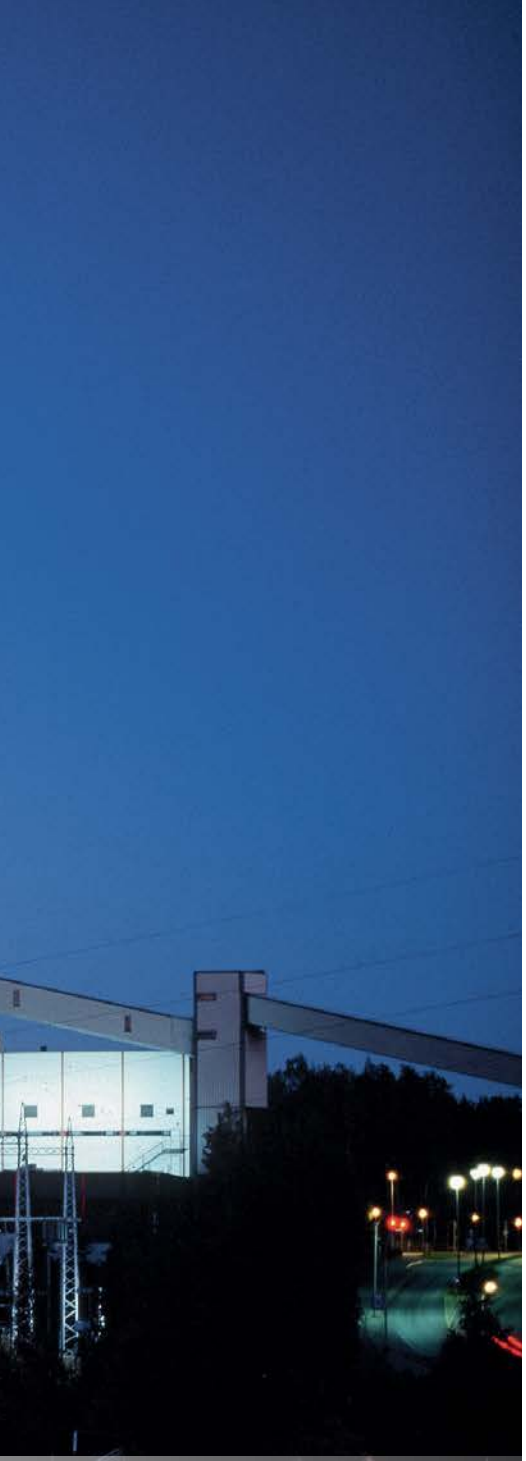
Volume measurement



Finding the center of gravity

MEASURING RATHER THAN CALCULATING

EFFICIENT GREENHOUSE GAS MEASUREMENT DIRECTLY IN THE STACK



Emissions trading requires facilities that generate greenhouse gases to take their own measurements and draw up reports concerning the volume of emissions that they produce. The EU directive that took effect at the beginning of 2013 saw the introduction of more stringent requirements when it comes to the accuracy of these measurements. The measurement uncertainty for high quantities of emissions must be below 2.5%. Vantaan Energia, an energy supplier based in Finland, has found a solution to this challenge thanks to the GHG-Control greenhouse gas measuring system by SICK.

>> Calculating the fuel-based greenhouse gas emissions for facilities run on oil or gas is relatively simple as these fuels are very uniform and the composition is known. Coal on the other hand is a different matter. That is because coal types can vary greatly in terms of composition, moisture levels, and other factors that affect the carbon content. Simply weighing the coal does not provide any reliable information or meet the required measurement uncertainty. Conventional solutions require coal-based power plants to weigh coal on the belt, take samples on a continuous basis, and set up a lab where these samples can then be analyzed. The values resulting from these processes can be used to calculate the amount of emissions produced. This calculation method involves high expense and an enormous amount of work.

Continuous greenhouse gas measurement in Martinlaakso

The power plant in Martinlaakso is one of the largest combined heat and power generation plants (CHP) in Finland. In 2013, the plant produced 14% of the electricity sold by Vantaan Energia and the majority of its district heat. The power plant has two boiler units, two steam turbines, and a separate gas turbine unit. Coal is the main source of fuel used in the Mar 2 boiler unit.

“The EU has issued a directive for the 2013 to 2020 emissions trading period. This directive specifies a maximum measurement uncertainty of 2.5% when measuring overall CO_2 emissions for our coal boiler,” explains Samuli Björkbacka, mechanical engineer at Vantaan Energia. “In 2012, we examined all of the reporting requirements closely, comparing various measurement techniques and clarifying countless numbers of technical details. Using a conventional measurement method would have been very complicated. We also ruled out using field tests since this would have required us to take samples from the belt. We would have had to take and break up several samples an hour and then analyze a collective sample on an hourly basis. The costs incurred by this method would have been very high and would require an employee for half a working day on a permanent basis.” Björkbacka explained that the project team was already aware of SICK from their work in the past and had had very good experiences of working with them. The GHG-Control CEMS solution developed by SICK to measure greenhouse gas was therefore considered as an alternative.

The GHG-Control greenhouse gas measuring system measures the concentration of CO_2 and, if necessary, the concentration of CO or N_2O directly in the flue duct. The technology used in the GM35 in-situ IR gas analyzer examines the absorption of infra-red rays to measure the concentration of CO_2 in the duct while the FLOWSIC100 volume flow measuring device determines the transit time of ultrasonic signals to measure the gas flow

GM35 in-situ gas analyzer – measures CO_2 and CO or N_2O simultaneously. The sender/receiver unit and the reflector are installed opposite one another in the gas duct. In this way, the light beam passes through the entire duct diameter twice in order to enhance accuracy; featuring integrated self-testing and control functions.

MEAC data acquisition system – for modern emission data management geared toward continuous detection, evaluation, visualization, and transmission of emission data and operating conditions; PC and software, automatic saving of all measured values; up to 16 measuring points can be connected; integration into process control system is possible.

FLOWSIC100 volume flow measuring device – ultra-precise and robust ultrasonic transducers made of titanium provide very high durability. The volume flow measurement can be configured as a single-path or multi-path measurement. Features automatic function control with zero and reference point testing.

rate. At least once a minute, all of the measured values collected are used to calculate the quantity of emissions. The final result gives an annual statistic for the hourly emissions load. The reliability and accuracy of the measurement plays a vital role. The GHG-Control greenhouse gas measuring system is practically maintenance-free. It has a 97% availability rate and its measurement uncertainty is less than 2.5%.

The challenge: accurate calibration

At the start, all signs seemed to indicate that emissions would not be able to be measured because a reliable system calibration would have been very complicated. To help overcome this issue, the company brought in experts from Indmeas Oy, a company specializing purely in industrial measurements, to help them analyze measurement uncertainty. The project team's biggest challenge was to verify the actual accuracy of the measurement system, combined with the question as to whether the system could be calibrated accurately enough. The solution to this challenge was natural gas, the boiler's supplementary fuel. Prior to the summer break, the boiler is run purely on natural gas for three to four days. The carbon content in natural gas is sufficiently uniform. The emissions flow speed and the precise diameter of the stack are needed in order to determine the volume flow. Measuring the diameter of the steel stack with accuracy to the nearest millimeter is relatively easy. However, thermal expansion must also be taken into account in order to meet the prescribed accuracy requirements. The company's business partner Indmeas was responsible for the accurate measurement and calculation as well as for issuing certification.

For regular system calibration, Indmeas takes a measurement prior to the summer break, examining the quantity of gas supplied to the boiler. It estimates the carbon content of the fuel while the plant is running on natural gas. It then measures the emissions flow rate and calculates the total quantity of carbon dioxide. This figure is calculated by measuring the concentration of carbon dioxide in the gases and then analyzing it in relation to the quantity of gas fed into the boiler and to the amount of coal burned.

Potential improvements for measurement and reporting

"For these measurements, we use a reporting system that records the measured values," explains Samuli Björkbacka. He goes on to confirm that this system works seamlessly. To date, the company has only had to carry out preventative maintenance work on the system. The quantity of emissions remains stable, particularly in winter when the boiler is running at full power. The quality of the coal is prone to fluctuate significantly. For example, the water content of coal is higher in winter than in summer." Depending on the current production situation, the coal boiler is run at various operational statuses. Previously, the emissions flow had been calculated using the flow equation and the angle of the fan blade. By the end of the period, this estimate was no longer correct. The flow equation is now no longer used and instead precise, realistic values are used to calculate the emissions load.

"The belt scales previously used to weigh coal would not have met the latest set of requirements for determining the quantity of coal," says Björkbacka. A new measurement system provides much more accurate values and gives operators more opportunities to use this information to monitor the plant's processes. Björkbacka also explains that there is still further potential for improvement in measurement and reporting processes as reporting is just as important as the measurements themselves.

Seamless team work with the experts at SICK

Samuli Björkbacka is happy with SICK's work thanks to the successful relationship with Kari Karhula, product manager at SICK Finland in Helsinki. Björkbacka found the product manager to be a capable and friendly business partner. SICK service manager Timo Välikangas is responsible for the system's maintenance and has also been on hand to help. The mounting process all went according to plan. A few members of the maintenance team at the Martinlaakso site spent a week preparing for the system's arrival before the SICK team arrived and installed the system in just a few days. The individual devices were delivered on schedule and installed as agreed. Following the manufacturer's calibration, the system provided the accurate results expected. As soon as the system had been installed, the flow measurement began working reliably straight away.

Solutions for emission and process control in a new waste incineration plant

Vantaan Energia opened a new waste incineration plant in fall 2014. A number of gas analyzers, dust measuring devices, analyzer solutions, and ultrasonic gas flow measuring devices by SICK were used in this new plant as well. The waste incineration plant is expected to generate 900 GWh of district heating output per year, which corresponds to an average of approximately 100 MW. This equates to almost two thirds of the district heating energy produced by the coal burner in Martinlaakso. For the past few years, the summer break there lasted two months but Samuli Björkbacka now estimates that the back-up period will be extended to 5 to 6 months. Now more heat is being generated by the waste incineration plant, the coal burner can been shut down earlier.

The FLOWSIC100 volume flow measuring device measures the gas flow speed

Vantaan Energia has always been conscious of the importance of corporate responsibility for energy companies. The company has made a number of changes that reflect their forward-thinking approach, not least the introduction of accurate emission measurement. The carbon dioxide emissions from the Martinlaakso plant are now measured in accordance with the exact level of measurement uncertainty prescribed by the EU. SICK's new technology saves time and resources. *(ro)*

The GM35 in-situ IR gas analyzer is installed in the stack and measures the concentration of CO_2 directly in the flue duct

More about the customer at:
www.vantaanenergia.fi

AN INTERVIEW WITH JOSEF WALTISBERG

“YOU NEVER KNOW WHAT IS IN THE STONES.”

The Swiss mechanical engineer Josef Waltisberg understands the cement industry and its measurement technology needs better than most. Employed as a project manager and selection consultant at an international cement company, the cement expert spent the past 30 years working all over the world. He now works as an international environmental consultant. He was happy to talk to SICK for an interview.

SICKinsight: Mr. Waltisberg, are there any special requirements when it comes to measuring harmful emissions for cement plants?

Josef Waltisberg: Of course there are! In power plants that use coal, the composition of harmful substances is always the same up to a certain point, regardless of the type of coal being burned. In cement plants, nearly all of the emissions (apart from nitrous oxides) are generated primarily by the raw materials. And the trace elements from a quarry in, say, Switzerland could be completely different to those from a quarry in the US. As such, you have to really put your gas matrix under the microscope as it can influence the selected measurement principle in ways that you could never predict.

SICKinsight: Could you give us an example of what might happen?

Josef Waltisberg: You never know what traces are in the stones or admixtures. For example, we once found traces of iodine which was distorting our mercury measurements. Iodine is never really the first thing you think of when red smoke suddenly starts appearing from your stack. But this is what happened at a waste incineration plant near Zurich a little while ago. Or take glycol for example. To help improve the milling output, a plant started using a grinding aid that was made more or less completely of glycol. When measuring absorption, the glycol line was very close to the HCl line. The HCl value seemed to suddenly jump from 4 to 40 mg/m^3, quite a long way above the threshold. The team at the plant nearly had a heart attack. However, SICK reacted perfectly. I took the ferry over from Switzerland to the SICK offices in Meers-

burg, where we tested the way that glycol could affect a device. SICK found the problem straight away and we could then correct the issue in the plant by using another absorption line for glycol.

SICKinsight: What are your experiences of the changes to measurement technology?

Josef Waltisberg: Before the 1980s, there were no regulations at all. One of my bosses at the time asked me to write a few points about the issue of nitrogen oxide. I ended up writing the first background report on NO_x. His response? "Interesting but do you think it will ever be a problem?" The first measurement devices were later tested in one of the plants. Sometimes we had to get a bit creative. For example, one of Swiss SICK team tinkered around a bit and came up with the very first hot measurement device. Then SICK brought us the prototype of the GM21, a combination device for dust and SO_2. A lot of plants started using it with other NO_x devices, even though these measurements were not obligatory at the time. The group of companies later implemented and monitored voluntary measurement standards all over the world. A number of countries even started using these standards as a legal basis.

SICKinsight: How has measurement work changed?

Josef Waltisberg: Back in the 1980s, NO_x was the big trend. Later, the German Waste Incineration and Co-Incineration Ordinance (also known as the 17th BImSchV) became the industry benchmark. Back then, we had just started burning solid waste with other fuels as a way of reducing our fuel costs. CO_2 also became an important issue as emissions from cement plants contain almost three times as much carbon dioxide as those from coal-fired power plants. These days, waste makes up as much as two thirds of all fuels used in Germany. The rise in energy prices also forced cement plants to cut heat consumption in their kilns. In Germany in the 1950s, one kilogram of clinker was burned with around 8000 kJ. By 1980, this had fallen to 4000 kJ. We have managed to reduce this to below 3500 kJ today but cannot cut it any further. Continuous measurement became obligatory in Europe for a number of harmful substances. Measurement-related work became a lot more complex in light of new additives and alternative fuels.

SICKinsight: Did you have to upgrade your measuring equipment on a regular basis?

Josef Waltisberg: No. The devices brought onto the market in the early 2000s already met requirements introduced a few years later. I can remember one case where a plant wanted to use a particular alternative fuel. The authorities requested an HCl measurement for this fuel. The plant had already been taking "inofficial" measurements for quite some time. The measurement simply had to be activated on the official computer. Finally, the requirements forced us to measure the composition of the gas in the kiln system itself. Special sampling probes and highly rugged gas analysis systems were launched to help meet these requirements. Gas is extracted from the kiln inlet at temperatures of roughly 1000 °C with a dust content of 0.5 to 1 kg per cubic meter of gas – an extremely challenging task for sampling probes.

"Gas is extracted from the kiln inlet at temperatures of roughly 1000 °C with a dust content of 0.5 to 1 kg per cubic meter of gas – an extremely challenging task for sampling probes."

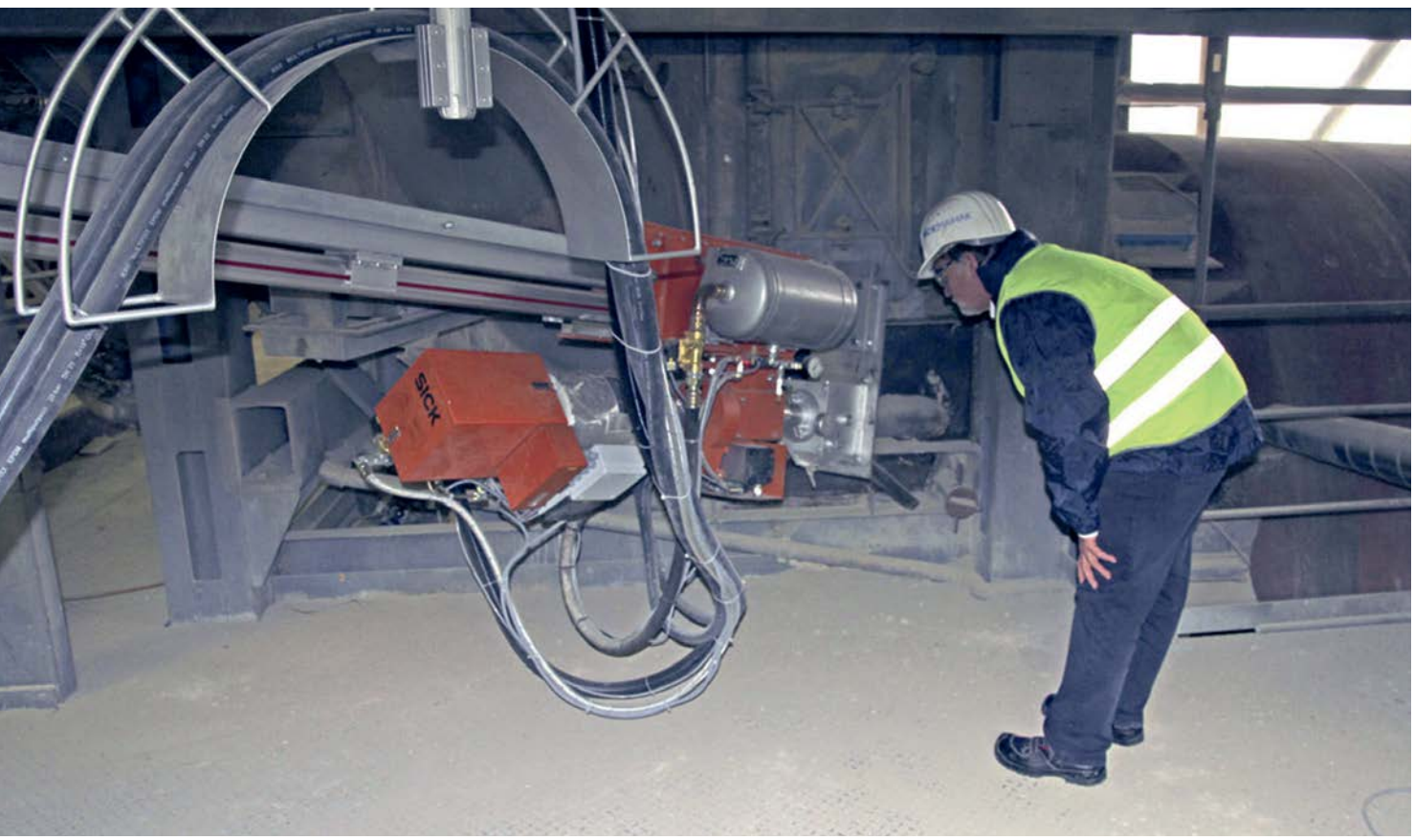
SICKinsight: Are standards now the same all over the world?

Josef Waltisberg: That is certainly the case for plants operated by international companies. That's because a problem at just one of the plants would result in the entire group being put under the microscope. However, some plants in developing countries are very outdated with high energy consumption and high emission levels. Then there are waste dumps that are still smoking. There is still a lot of potential for savings. Some places do not even use the waste that gathers around the plant as they have not yet set up an organized system for collecting it. However, members of the cement industry all over the world are determined to make the most of this energy.

SICKinsight: When will the current systems reach their limits?

Josef Waltisberg: Not long. This is an area that requires constant development. Take mercury for instance. At the moment, there are around five devices with QAL1 certification for mercury-based requirements in Europe. The European limit for the co-incineration of waste is currently 30 µg/m^3. However, the US is planning to cut its limit to below 10 µg/m^3. This will also affect Europe and ultimately means that measurement devices will also be subject to stricter requirements.

"I could always rely on a good working relationship with SICK. The head of the cement sector, Manfred Stromberg, worked in the area for many years and I knew I could call him any time I had a problem."



> "Working with SICK Germany and the local service office, we provided the team at the plant with in-depth, practical training on the devices themselves."

The MERCEM300Z mercury gas analyzer from SICK already meets these requirements. Ten years ago I was telling the audiences at my talks that we needed a measuring device that could measure mercury at very high temperatures above 800 °C. And SICK has done it!

SICKinsight: You have been working with SICK products for a long time. How do you rate us as a supplier?

Josef Waltisberg: I could always rely on a good working relationship with SICK. The head of the cement sector, Manfred Stromberg, worked in the area for many years and I knew I could call him any time I had a problem. And even if he was not responsible for the issue, he always put me in touch with the person who could help. That type of relationship is vital. To begin with, I only knew SICK as a provider of dust measurement technology. These days, SICK provides the widest range of products on the market for all gas measurement tasks. It really helps to have just one contact for all types of measurement equipment.

SICKinsight: How important are the local service offices in other countries?

Josef Waltisberg: Really important! Otherwise, measuring devices may not always be accepted and they are then not properly maintained. In one plant, availability fell to below 50% and the finger was being pointed at SICK. When I arrived on site, I found that the sampling filter had not been changed for over a year and had become completely blocked. Working with SICK Germany and the local service office, we provided the team at the plant with in-depth, practical training on the devices themselves. This was very well received. It also provided the plant with a chance to get to know the local service team. In the end, availability could be increased to above 95%.

SICKinsight: Thank you very much for speaking to us, Mr. Waltisberg.

EMISSION DATA MANAGEMENT

ELECTRICITY ALL DAY EVERYDAY – CLEAN POWER IS A MUST

Public bodies ask for full and accurate reports: has the company in question adhered to the limits for environmental emissions at fossil fuel power plants, hazardous waste incineration plants, and biomass-based power plants? Simple-to-use data acquisition systems that are not susceptible to faults or failures are therefore crucial for companies operating this type of facility. The MEAC data acquisition system by SICK is reliable and popular with customers, providing them with a solution for the continuous recording, analysis, and transmission of emission data. Expert service included.

>> Conventional power plants, renewable energy plants, and smaller, decentralized energy systems: this is what the electricity production landscape currently looks like in Germany. However, just like everywhere else in the world, large fossil fuel power plants still play a significant role. Burning fossil fuels does not necessarily have to have a negative effect on the environment. The cleanest fuel with the lowest level of CO_2 emissions is in fact natural gas. Now, coal-based power plants are moving with the times and investing in new technology to reduce the amount of harmful substances in emissions. Products like dust filters, desulfurization units, and nitrogen removal systems “de-toxify” flue gases. Saving primary energy means increasing the efficiency of the combustion process and thus increasing the energy efficiency. Increasing the efficiency automatically reduces the amount of CO_2 emissions. Based on an energy output of one third a few years ago, the tendency is now pointing towards a level of around 50% today. The remaining 50% is lost as residual heat.

Protecting the environment by reducing emissions: that is the current goal for the energy supplier Mark-E. A regional energy company based in North-Rhine Westphalia, Germany, Mark-E runs several power plants in a number of locations fueled by coal, gas, water, wind, and solar power. The company opened the region's first power plant run on biomass back in 2004. For its CO_2-neutral energy production processes, Mark-E uses up to 600 t of scrap wood and other biogenic waste every day, some of which is provided by a local paper factory. When compared to a coal-burning power plant, this corresponds to around 160,000 t less carbon dioxide emitted every year. However, Mark-E also uses coal, natural gas, and oil for its heating

plants. The authorities make sure that the plants adhere to legal limits.

A good connection with the authorities

The quality of emissions has to be monitored and analyzed over time so that comprehensive documentation can be provided to the environmental authorities. Mark-E counts on SICK's reliable, tried-and-tested emission data management system for this purpose that records data safely, calculates, analyzes, and displays figures, and transmits data remotely. It records measured values and operating data on a second-by-second basis and stores it on a continuous basis. Mark-E has been working happily with the MEAC data acquisition system since 2007. So that it can continue to report environmental data in accordance with the new German guidelines for the uniform practice for monitoring emissions, Mark-E has decided to upgrade the MEAC2000 to the MEAC2012 in all of its plants – just like the saying goes, “never change a winning team.”

The MEAC2012 meets all requirements set out under current German legislation and automatically implements these rules in conjunction with the individual settings for the customer's system. The data from all measurement points is recorded remotely and then analyzed. It is transmitted on the company's internal network and compiled on a central PC so that it can be read off easily from one location. Mark-E also expressed its interest in a reduced network – SICK forwards all data directly to Mark-E's central server so that the power plant managers do not have to spend lots of time going back and forth to coordinate the various parties. The individual Mark-E power plants do not have to worry about transmitting emission data to the local authorities either. The MEAC2012 does this automatically by transferring the daily means and event reports to the authority's system via a modem.

And the environmental officers and system operators do not need time to get to grips with a new system: the customary user-friendly MEAC design remains the same and all existing data can continue to be displayed.

High-speed information is the key to availability

Mark-E's second key objective is to keep all downtime risks as low as possible, not just in production and for the measuring devices, but also in service. This is where safe remote maintenance can help to solve many problems. SICK's web-based remote maintenance system meets all the requirements issued by the German Office for Information Security (the BSI) and is therefore completely safe. Its demands on Mark-E's firewall are kept to a minimum. The Meeting Point Router (MRP) is the connection hub for all data recording units and machines incorporated into the remote service system. The user simply has to press the MPR touchscreen to request SICK to carry out remote maintenance. A SICK service technician will then be on hand within a specified response time to provide the user with help and advice for remote service. Mark-E is connected to SICK's web-based Remote Service Center via highly encrypted data channels with HTTPS and SSH authentication standards. Connection reports can be viewed on the portal at any time. As such, Mark-E can always see who has requested remote service and when a remote maintenance session has been carried out. *(sh)*

MEASURING DUST EMISSIONS

DO WE NOT ALL HAVE THE RIGHT TO CLEANER AIR AND LESS POLLUTED SOILS?

Measuring dust emissions is easy – if one has the right measuring equipment. When it comes to choosing the right measuring device, one has to look at both the properties of the medium to be measured and the environmental conditions. This is where SICK's strengths really come into their own – tried-and-tested measurement principles applied in a diverse portfolio of products and combined with decades of experience in thousands of different installations. It is not simply a question of complying with legal requirements. Many companies want to reduce their dust emissions because we all want to breathe clean air.

>> We have a right to clean water. This right was recognized by the United Nations in 2010. So do we not also have the right to cleaner air or less polluted soils? The UN has no explicit plans to acknowledge these rights at the moment. However, campaigns run all over the world with the aim of improving the health of our environment. These type of campaigns pay off: you simply have to look at the health care savings for respiratory-related disorders. Even these days, high levels of fine dust is thought to reduce the average life expectancy in Germany by around one year. The EU declared 2013 as the “Year of Air”. The European Commission set itself the goal of revising the entire clean air policy for Europe, putting forward a number of new proposals. Governments have now been tasked with improving or even tightening these guidelines – both within Europe and beyond.

Emission measurement also includes measuring the level of dust and dust particle emissions in waste gases. This involves monitoring the concentration of fine dust and soot in traffic, as well as emissions from private heating systems. The production industry also carries a great deal of responsibility. Taking measurements in this setting is complicated – one simply has to look at the wide array of possible particles and dusts to recognize this. From the visible to the practically invisible. From the floating to the settled, be they soot, smoke, or dust. In an array of different shapes, sizes, surfaces, and chemical structures. The location where the measurement is taken also plays a key role in ensuring that the right technology is used to provide reliable and accurate measurements without any effort. One then also has to define the measurement range, the flow conditions, the concentration range, the composition of the gas, and the ambient conditions.

Seven questions for finding the right measuring device

Which measurement technology is best? Which device version is most suited to the task at hand? When it comes to a certain aspect, all measurement technicians only want one thing: rugged measuring devices that provide accurate and fast measurements with a high level of availability. The more detailed the description of the task at hand, the easier it is to provide a safe and cost-effective measurement. And this does not just apply to the initial investment costs, it applies for the device's entire operating life. Whether it is used for dry, corrosive, or hot flue gases. Whether it is used in process control for measuring moist emissions, for the smallest concentration of dust following fabric and bag filters, or for high concentrations of dust in raw gas prior to electric filters. For personal and occupational safety purposes, fine dust with particle sizes in the low µm range have to be monitored in the air in production halls. SICK's dust measuring devices can even provide effective and accurate measurements for the excessive development of dust by grinders in quarries. SICK offers the best solution no matter what the task at hand.

Anything is possible

Environmental standards are becoming more stringent, often requiring companies to measure low concentrations of dust. This task requires a particularly sensitive measuring process. Ever since Erwin Sick conducted his pioneering work in 1956, SICK has been concentrating on optical measurement processes. The scattered light approach provides the best foundation for recording even the lowest concentration of dust. This also

applies for more demanding applications in hot or aggressive gases with low to medium dust content. The DUSTHUNTER SB50 and SB100 scattered light dust measuring devices apply the backward scattering principle. Installing the devices in a stack is easy: a single opening is enough.

Stacks with thicker walls require dust measuring devices to have a special shape without sacrificing any of the measurement accuracy, even for the lowest concentrations of dust. Other stacks require the measuring device to be installed in one exceptionally small opening. For these two scenarios, the DUSTHUNTER SP100 comes with a special probe with graduated lengths from 435 to 2,435 mm. The maximum drill hole diameter required is 130 mm. Made from stainless steel, titanium or Hastelloy, the probes are well equipped to withstand hot or corrosive substances. The DUSTHUNTER SP100 also uses the scattered light principle, applying highly sensitive forward scattering.

The DUSTHUNTER SF100 is SICK's solution for particularly difficult cases when it comes to the shape of the stack and the properties of the medium. If the flow is affected by inhomogeneities or swirling in larger channels, it can make representative dust measurement more difficult. The problem can only be solved by taking a measurement across the entire diameter of the stack. The DUSTHUNTER SF100 also uses the scattered light principle (forwards scattering). Its receiver is installed opposite the sender on the other side of the stack, making it the ideal solution for measuring larger

diameters. It can even measure the lowest concentration of dust with maximum precision. However, it is also suitable for use with corrosive and hot media. The DUSTHUNTER SF100 makes almost no contact with the medium itself. A single measurement across the entire cross section of the stack quickly records the concentration values.

Transmittance also uses a conventional optical process, making it ideal for measuring medium to high concentrations of dust: the DUSTHUNTER T50, T100, and T200 transmittance dust measuring devices. The DUSTHUNTER T50 is all you need to tackle simple measurements. Like SICK's measuring devices that use the scattered light principle, the DUSTHUNTER T100 includes an automatic contamination measurement and correction function. It provides users with an early warning should the contamination level on the measurement optics exceed the permitted limit. The DUSTHUNTER T200 is also equipped with an automatic self-alignment function for the optics: a unique feature only available in SICK products. It corrects any distortion on the optical axis that may occur as a result of the thermal expansion of the stack. Both functions reduce excessive maintenance cycles. The automatic self-alignment function also makes it easier to commission the device.

Sometimes, things may get a little damp...

In some processes, exhaust gases are cleaned in scrubber units before they are released. Recording a reliable measurement for dust concentration is particularly difficult when the dust is damp. Conventional dust measuring devices cannot differentiate between specks of dust and drops of water, leading to distorted measurement readings. Only one thing can help here: using a bypass system to extract the medium from the stack, dry it, and then measure it. This is the approach applied by the extractive scattered light dust measuring device, the FWE200DH. It extracts flue gas from the stack on a permanent basis, dries it within a few seconds using a thermo cyclone, and records particularly low concentrations of dust accurately using forward light scattering. The FWE200DH features a space-saving design and can therefore be installed straight into the stack. It is equipped with a corrosion-resistant sampling probe made from PVDF.

... and sometimes extremely dusty

Dust extraction systems play a key role in the purification of air. Filter defects have to be detected at an early stage before the system can exceed the specified limits. The FW102 scattered light dust measuring device is installed on one side of the clean gas duct downstream from the filter. It measures dust regardless of the gas velocity, humidity, or dust particle charges.

Without worries

Once installed, operators do not need to worry about looking after the measuring devices by SICK. They all feature a rugged design and boast long maintenance intervals, partly due to their automatic self-monitoring function. And if dust measurement helps to further reduce the number of harmful pollutants released into the air, it will also reduce the amount of dangerous immissions released into the water and soil. The UN has now declared 2015 as the international “Year of the Soils.” This campaign has also been set up to improve environmental awareness. Unpolluted soil is crucial to the agricultural industry and forms a strong foundation for a sustainable ecological system and a healthy climate. *(sh)*

Seven questions for finding the right measuring device

- **Measurement location**
  Stack? Raw gas or clean gas duct? Hall or waste heap monitoring? Where is the measuring device going to be installed? On one side or on two sides with a platform?
- **Measurement range**
  Small flue gas channels or a stack with a large diameter? How long is the measurement range? An accurate measurement can be taken across a range from 0.25 m to 12 m.
- **Flow conditions**
  Uniform or swirled flows? How does the gas flow affect the dust concentration measurement?
- **Concentration range**
  Low or medium to very high concentrations? What is the concentration of particles like? The devices can safely record figures of < 1 mg/m³.
- **Composition of the gas**
  From ambient air to aggressive gas: what is the structure of the medium to be measured? Does it contain salt or is it mainly made up of fine dust?
- **Properties of the particles**
  Size, shape, color, material, or density. Abrasive or sticky? What particle properties have to be taken into account? How could they affect the measurement?
- **Environmental conditions**
  What is the ambient temperature? What is the process pressure? What is the humidity of the process gas? Does the device need approval for explosive environments?

SAFE TECHNOLOGY FOR MEASURING THE CONCENTRATION OF HYDROCARBONS

ALL SYSTEMS GO

You need a measurement expert if you want to take safe and accurate measurements of the concentration of hydrocarbons during production processes. The flame ionization detector has proved to be a successful solution in analysis measurement technology. SICK's FID devices measure the total quantity of hydrocarbons when monitoring emissions or play a direct role in the process by acting as a gas warning device. SICK is currently the only manufacturer that meets the requirements set out in EN 50271 for measuring the lower explosive limit in air that contains solvents. This is a very important point as companies are required to adhere to legal requirements for explosion prevention and occupational safety at all times. And not forgetting environmental requirements, too.

>> Whenever hydrocarbons are released, stored, or transported, companies are required to comply with laws and regulations to remove the risk of accidents or damage to health as far as possible. Hydrocarbons form the main component of volatile organic compounds (VOC) in industrial emissions and are classed as harmful to the environment. When hydrocarbons evaporate and mix with the air, they may become explosive. This is precisely the reason why measurement technicians want to keep concentration levels firmly under control, even the lowest ranges where possible. And they want to stay safe. Measurement technology and analysis technology therefore play a crucial role in both process analytics and emission monitoring.

Impressive technology

Flame ionization detection is one of the most typical technologies used. It is ideal for applications where companies are required to provide quick and accurate readings of the total concentration of hydrocarbons during the gaseous phase. Compared to other technologies, this measurement approach records all hydrocarbons (no matter how complex the compound) with high levels of sensitivity and linearity.

Flame ionization detection is used in detectors (FID) for gas chromatography and for emission measurement. SICK is also

on hand to help with the monitoring of volatile concentrations prior to exhaust air purification systems, the continuous monitoring of the lower explosive limit (LEL), and with leakage detection in vessels containing solvents. “Better than many other FIDs:” SICK's devices are in high demand.

Early warning

When large quantities of volatile and flammable hydrocarbons are released to mix with the air, there is always a risk of explosion if their concentration reaches a certain level. In some processes, it is impossible to prevent mixtures containing a high concentration of volatile hydrocarbons from dispersing in the air. As such, quick measurements for the lower explosive limit (LEL) and reliable information concerning the current status of the process air are important for plant safety.

High concentrations of hydrocarbons may occur in coil coating facilities, for example. Strips of metal are coated with one or more layers, normally using materials like paints or plastics. These coatings are dissolved using solvents. Once coated, the coils are dried so that the solvent can evaporate. The finished product is a compound made up of a metallic base material and the coating. The product is processed further and used as a packaging material for consumer or blister packages, or used to manufacture household appliances (white goods). The coating process only takes a few minutes. Depending on the width of the coil, the metal coils move at a speed between 10 and 1,000 m/min. The coating and subsequent drying processes generate a waste gas that contains solvents. Companies that operate this type of plant are required to measure the %-LEL and keep the concentration of hydrocarbons below a certain level, e.g., below the 25% LEL. An FID device is very good at measuring these figures as it records the total quantity of all hydrocarbons.

When an FID or similar device is used as a gas warning device for either switching off the system or simply for controlling it, the analyzer must comply with EN 50271:2011. This standard sets out a number of requirements and checks for electrical devices used for detecting and measuring combustible gases. The EuroFID3010 by SICK has been successfully certified according to this standard and is currently the only FID device on the market to have been so.

Companies have been using the EuroFID3010 to successfully measure the LEL for several years now. Undergoing constant development, it has proved to be ideal for use in kilns or drying units and for processes in the chemical and HPI industry. The EuroFID3010 has very quick response times (T90) and monitors the value of the lower explosive limit for various solvent compounds. Rugged yet still exceptionally sensitive, the analyzer can also be used in waste gas purification systems. The LEL is measured as the air enters the system, with the corresponding emission values measured upon output.

A glimpse into the future of emission measurement

A constant flow of information is crucial for emission monitoring. With availability of 99.5%, the compact GMS800 FIDOR extractive gas analyzer is already a few steps ahead of its competitors. Available as a stand-alone variant or integrated into a measurement system, measurement technicians in waste incineration plants, power plants, and cement factories are very happy with both variants of the device. A rugged design, simple controls, quick circulation of gas, and accurate measurements provide a safe method for monitoring the total concentration of all hydrocarbons. The suitability test covered the analyzer, the measurement system and probe, heated sample gas inlet, and catalytic converter. As a result, the entire system is certified as suitable under EN 15267.

Requirements concerning the availability and safe operation of analysis devices are expected to become even more stringent in future when it comes to functional safety. This not only poses a challenge to the facility operators but also to the manufacturers of analysis devices. SICK is there to help every step of the way. *(sh)*

MERCURY MEASUREMENT

STRICTER LIMITS FOR MERCURY EMISSIONS?

The thresholds for mercury emissions are already as low as the µg spectrum. To be able to monitor even tighter restrictions, measuring devices need to be extremely sensitive, accurate, and reliable.

>> These days, it is hard to believe that mercury (Hg) was still being used to cure illnesses at the beginning of the 20th century. Due to its deeply harmful properties, strict regulations regarding the use of this heavy metal now apply in a number of areas. In its liquid form, mercury evaporates at temperatures as low as room temperature. Impossible to see or smell, it is also a neurotoxin when inhaled into the lungs. As an exceptionally volatile substance, mercury can spread across large areas. Scientific institutes are currently taking measurements in polar regions to find maximum mercury values. As a result, UN climate policies are now demanding even stricter requirements to keep emissions of this toxic substance to a minimum. In January 2013, a total of 140 countries signed up to the Minamata Convention in Geneva, Switzerland, pledging to limit the mining of mercury, cut the amount of mercury emissions, and monitor waste.

Emission monitoring requirements focus primarily on power plants, incineration plants, and cement kilns that burn fossil fuels or waste. Waste incineration plants, for instance, have to pay special attention to items like batteries that have not been disposed of correctly and other electronic devices that contain mercury. Plant operators are adapting to these changes by employing better filter systems, improved gas cleaning systems, and even more accurate emission measurement devices to remain below the thresholds. The US government already drastically cut the limit for mercury emissions back in 2012 in light of the health risks posed by the substance. In Europe, the limit is specified by IED 2010/75/EU and is still a little higher than in the US. However, plant operators all over the world should already start preparing themselves for lower measuring ranges.

There are a number of products on the market that promise users accurate emission measurements. However, not all of these products are suited to meet the complex requirements. All statutory requirements are based on absolute emissions values, in other words, the sum total of elemental mercury Hg^0 and oxidized mercury Hg^+. The amounts and ratios of these two mercury forms in the flue gas depend largely on the raw materials being incinerated, the additional fuels, the gas flow in the process, and the purification process used for the flue gas. A quick and reliable mercury analyzer that can monitor both forms of mercury is therefore crucial to the measurement process. This is where the MERCEM300Z by SICK comes in. The gas analyzer provides extremely reliable monitoring of mercury emissions down to the lowest certified measuring range of 0 bis 10 µg/m³. It is the only product on the market able to cover this measuring range; in fact, the range is almost five times lower than other Hg analyzers.

The MERCEM300Z combines thermal conversion at temperatures of around 1,000 °C with the fast measurement of trace or low Hg concentrations directly inside the heated converter. This enables it to supply reliable and continuous readings for actual flue gas concentrations. Continuous measurement directly in the hot converter combined with Zeeman atomic absorption spectroscopy (AAS) is patented and has

been licensed exclusively for the MERCEM300Z from SICK. No chemical conversion, no particulate converter, and no gas cooling that may quickly distort the measurement result. Thanks to AAS technology, the measurement will not be affected by any other interfering components either. The certified maintenance interval of six months makes the MERCEM300Z truly unique.

In the US, cement and power plant operators are also very happy with the mercury analyzer by SICK. In the US, emission limits are not based on a daily average but instead look at a 30-day average. Another difference between the two regions is that the US has once again tightened its emission limits, posing an even greater challenge for gas analyzers. To get a clearer view of the situation, one simply has to look at the limits set there. The emission limits for a newly-constructed coal-based power plant are 30 times smaller than the current limit in Europe.

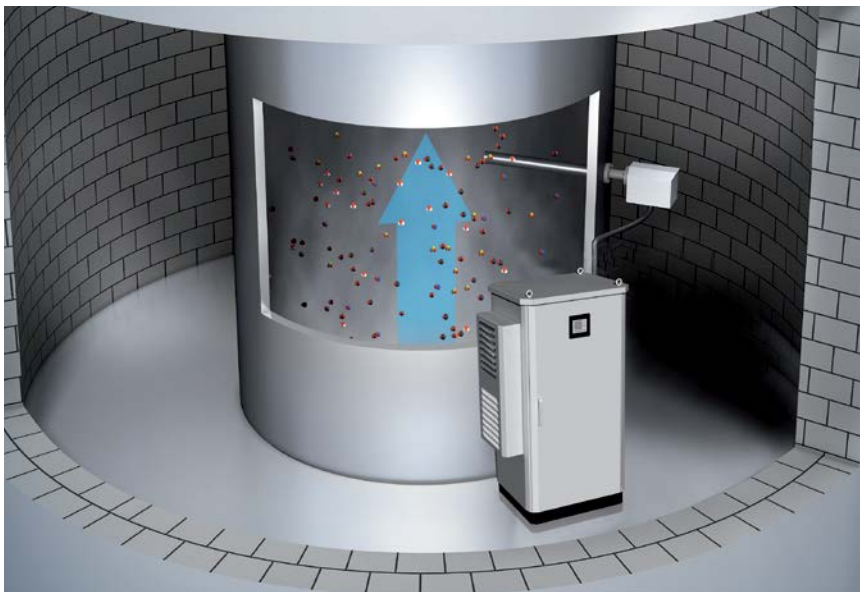
The sooner, the better: measuring mercury in raw gas

Reducing the level of mercury during the treatment process is a sure way of adhering to emission limits at the end of the process. Improved measures for cleaning the raw gas enables plant operators to save additional costs and increase the safety of their systems. And this applies no matter what type of system is used.

In comparison to emission measurement, measuring mercury levels prior to the electric filter or prior to the scrubber requires a lot more effort due to the higher levels of dust and high concentrations of interfering components such as sulfur dioxide or hydrochloric acid. Nevertheless, the Hg value still has to be recorded at levels as low as the mg/Nm³ range. Measurement methods using an additional amalgamation step can be ruled out from the outset. This option would take too long to respond to Hg peaks.

Thanks to Zeeman AAS technology, the MERCEM300Z is also ideally equipped to take measurements in raw gas. The gas analyzer enables measurements to be taken without any further settings, without any additional equipment, and without any complicated operations. The set-up is exactly the same as for emission measurement. The MERCEM300Z is consistently accurate, detecting even the smallest milligram of mercury. It also boasts fast response times so that operators can react quickly to fluctuating concentrations of mercury.

The majority of all flue gas cleaning units tend not to come with a cleaning stage designed especially for mercury. Injection of activated carbon prior to the electric filter or precipitants for the scrubber remove mercury from the process gas. However, these chemical additives are expensive and are often cut out of the process just for safety reasons. Operators are able to cut costs if they adjust the dosage according to current needs. The MERCEM300Z supplies reliable measured values for this purpose. If high levels of mercury collect over a longer period, this may lead to an excess of mercury in the flue gas scrubber and ultimately end up contaminating the entire system. In a worst case scenario, the entire facility may have to be brought to a stop. However, this can be avoided. If an accurate measurement process enables high Hg concentrations to be detected in the raw gas, measures can be introduced to counteract them. *(sh)*



MERCEM300Z uses hot extractive measurement: the flue gas is extracted using a sampling probe and then transported to the analyzer via a sample gas inlet. Any of the analyzer's components that come into contact with the sample gas (the probe, sample gas inlet, converter) are heated to above the dew point.

EMISSION MONITORING IN THE SHIPPING INDUSTRY

FULL SPEED AHEAD: IT PAYS TO PROTECT THE ENVIRONMENT

Heavy crude oil is a cost-effective fuel that is widely used in the shipping industry. This tar-like product is left over from the petroleum treatment process and contains very high levels of sulfur and heavy metals. Depending on its size, load weight, and operation, a container ship will consume an average of 50 tonnes of heavy crude oil for each day at sea. Proportional amounts of carbon dioxide, sulfur dioxide, nitrogen oxides, and soot are released out at sea through the funnel. One alternative for heavy crude oil is diesel oil, though it is twice as expensive. Another option would be to install exhaust gas purification systems into the ships. A catalytic converter cleans nitrogen oxide while a scrubber unit removes the sulfur oxide from the exhaust gas. And SICK's ship emission measuring device provides proof that the ship is adhering to all the requirements in the MARPOL convention for preventing pollution in the marine environment.

>> Anyone equipping a ship with state-of-the-art technology for exhaust gas cleaning and the MARSIC ship emission measuring device by SICK will meet all emission regulations with ease in the long term. The measuring range and measurement accuracy in the MARSIC device already meet all of the stringent requirements set out in the MARPOL convention. The measuring devices have been specially designed for use on ships, require very little maintenance, and boast a simple service program. The costs are balanced out within a very short space of time: the MARSIC helps to save fuel and make the ship's engines even more economical.

Ship emissions play a key role

A large majority of the world's trade is conducted via tankers, carriers, and container ships. Along with passenger ships, around 54,000 ships sail the oceans and around 3,500 more are added every year. It is therefore all the more surprising that the maritime regulations are not as strict as the ones in force on roads, for instance. Marine fuels are permitted to contain a maximum of 3.5% sulfur. That is 3,500 times more than in the diesel used in trucks. However, this is all due to change by 2020 at the latest. New international regulations will limit the sulfur content in marine fuels to just 0.5%. For the North Sea, Baltic Sea, and the North American bodies of water, even stricter pollutant regulations will take effect from 2015, as the sulfur content will be restricted to 0.1%. Ships are responsible for 80% of all soot emitted by all forms of transport around the world. It is only with regard to CO_2 emissions as a ratio to the quantity of transported goods that marine transport can boast a relatively good record compared against rail, road, or air transport.

A breath of fresh air from MARSIC

The engineers in the ship's engine room are now also environmental officers. They monitor the exhaust gas values and the performance of the gas scrubbers – large "showers" which all exhaust gases pass through. Measuring devices for analyzing gas help engineers by continuously recording and monitoring the substances emitted from the ship's funnel. The MARSIC200 by SICK uses cold extractive measurement while the MARSIC300 applies the hot extractive method. MARSIC can serve up to eight measurement points and measure up to nine components at once: SO_2, CO_2, CO, NO, NO_2, NH_3, CH_4, O_2, and H_2O. Furthermore, the MARSIC200 and MARSIC300 help to improve processes on board, such as engine and catalytic converter management processes: they measure CH_4 slip in LNG (liquefied natural gas) and dual fuel engines, and also measure CO_2, O_2, CO, and NO_x to improve fuel consumption in the ship's engines. The measured values recorded by SICK's ship emission measuring device are correct and accurate at all times, while all results are documented within a short space of time. SICK has developed a special modular design for the MARSIC200 and the MARSIC300, making maintenance procedures quicker for the on-board engineers. Should worse come to worst, defective parts can be replaced without needing any specialist knowledge of measurement technology.

Helping to protect the environment

The owners of the Containerships VII are one of the first companies to equip their ship with a cleaner engine and use SICK devices to document its emission measurement data in accordance with the MARPOL convention. Antti Hyvönnen, the head engineer on board the Containerships VII, explains: "I know when technology is good if I don't have to worry about it. You need to be able to rely on things when you're out at sea."

Even environmentally friendly cruise ships are now in operation – some even boast emission values that are below the maximum limits. By establishing their own environment management concepts, cruise ship owners are able to react quickly to new trends, legal specifications, and improvements. They have now started to use innovative environmentally-friendly technology on board. *(kl)*

Certified for all applications

The MARSIC range of devices has received type approval in accordance with DNV GL and can be used for all applications pursuant to MEPC.184(59) and NO_x Technical Code Point 2.1.2.

- Pre-certification of marine diesel engines on a test bed (NTC 2008, Chapter 5)
- On-board testing for engines which have no pre-certification
- On-board simplified measurement method (NTC 2008, Chapter 6.3)
- On-board direct measurement and monitoring (NTC 2008, Chapter 6.4)
- Control of exhaust gas cleaning systems according to Scheme A and B of MEPC.18

SENSORS FOR WIND AND SOLAR POWER PLANTS

RENEWABLE ENERGY: POWER FOR THE FUTURE

Renewable energy such as wind and solar power is a source of energy with an almost completely limitless supply and countless benefits. For a lot of people, the nuclear disaster in Fukushima confirmed just how important these safe resources really are. Sensors by SICK are used in both wind power plants and in solar energy systems.

>> Wind power is currently the most important source of renewable energy in Germany. Based on the amount of electricity generated, solar energy has only contributed a limited portion of total electricity production in Germany. By giving customers the chance to install photovoltaic systems on their roofs, solar energy production also appeals to investors outside of the industrial sector.

The wind and solar power markets are becoming increasingly competitive. Companies from China and the USA are now making their presence known. In order to remain competitive, companies are investing in new technical solutions that offer additional functions while still remaining cost-effective.

SICK's range of new products offers companies a starting point for cutting overall costs and maintenance requirements.

WIND POWER

Rotational movement monitoring made easy

The AHM36 absolute encoder is a new solution for adjusting the pitch and azimuth angle. The 36 mm encoder is equipped with full magnetic technology in a single-turn or multi-turn design for maximum reliability in tough conditions. Its compact design means that the AHM36 is ideal for installation in cam limit switches. In this case, the encoder records the position of the azimuth.

The encoder and motor feedback systems also monitor the rotational speed and provide information about the speed and commutation angle.

Shock and vibration resistant: the inductive proximity sensors are ideal for use in wind power plants

New rugged inductive sensors

The new inductive proximity sensors from the IMB product family by SICK are perfectly suited for the tough conditions on wind power plants thanks to their high level of shock and vibration resistance and their extensive temperature range. The majority of wind power plant manufacturers use inductive sensors to measure the speed of the powertrain. Inductive sensors can also be used to record the maximum position of the rotary blades and the position of the gondola.

Safe switch-off function in the event of excess speed

The MOC3SA speed monitor by SICK offers users a safe and reliable solution for switching off wind power plants should the speed become too high. Equipped with two inductive proximity sensors, it can monitor switch cams. The speed monitor is equipped with four safe semiconductor outputs, two application diagnostic outputs for fault and status displays, and diagnosis LEDs for easier commissioning and monitoring. The MOC3SA can be used in accordance with PL e (EN ISO 13849), SIL3 (IEC 61508), SILCL 3 (EN 62061).

Fluid sensors: new solutions and opportunities

The LFP Cubic TDR level sensor continuously measures the level of the hydraulic oil tank. A teach-in button sets new switching points for the limit values on a continuous basis. As a result, users can benefit from reliable and continuous level measurement and limit value detection in one single device. The PBT pressure transmitter monitors the pressure in the hydraulic cylinder and boasts a compact yet rugged design. The membrane and the housing are made from 316L stainless steel. The PFT pressure transmitter monitors the capacity in the transmission and the pressure in the cooling system. The TSP resistance thermometer takes care of the temperature in the cooling system. The LFV200 vibrating level switch is responsible for monitoring the level of the transmission oil.

Maximum flexibility thanks to length-adjustable and replaceable single probes and flexible probes: the LFP Cubic

SOLAR

Solar tracking: chasing the sun

At certain latitudes, it may be useful for solar panels to track the sun to improve the production of solar energy. Using the current position of the sun, tracking systems can yield up to 40% more energy than systems without tracking. In principle, several different sensor solutions can be used depending on the design and the application of the tracker systems. Inductive proximity sensors like the IME by SICK provide customers with a cost-efficient method for recording positions using individual switching points. If the customer is looking for more precise tracking solutions, they can try incremental encoders or absolute encoders. All of the encoder families produced by SICK feature the same compact design. If required, the SOPAS software tool can help to configure the encoder's resolution and output level (depending on the design).

Producing heat from the sun's rays: solar thermal energy

Solar thermal energy describes the use of the sun's rays for heating buildings and water. In concentrated solar power systems, thousands of mirrors concentrate the sun's rays on one absorbent surface. This surface is where the water

heats up and then flows through lines into a heat storage tank or straight to the power plant to generate electricity. The new AFM60 modbus absolute encoder by SICK is used for precise mirror adjustment. The encoders help the mirrors to concentrate the sunlight at exactly the right point on the tower, where the energy can then be harnessed accordingly.

Flexible solar modules (organic photovoltaic)

The non-breakable flexible modules are significantly thinner and much lighter than conventional solar modules. As they do not use glass, the amount of energy needed to produce the modules falls dramatically and in turn helps to reduce manufacturing costs significantly. The option to integrate the flexible modules into roofing material and building cladding provides customers with a cost-efficient system solution. The light-weight design means that they can be installed on surfaces that would not be able to hold heavier modules for structural reasons. The modules can be installed directly onto the roofing membrane, getting rid of timely and costly mounting solutions using special sub-constructions. However, the energy efficiency cannot compare with the level provided by conventional crystalline glass modules.

Sensors for detection and positioning are used in the production of flexible solar modules. They also conduct quality checks and provide reliable protection for staff in the production area. The sensors from SICK provide valuable support for the operation of wind and solar power plants. They play a role in ensuring that wind power plants and solar parks work efficiently – even under very challenging climatic conditions. *(ir)*

Quality checks for the production of solar modules with the Inspector PIM-series

SAFETY SERVICES WITH A GLOBAL PROCESS STANDARD

VERIFIED SAFETY – SAFE PROCESSES HELP TO GUARANTEE GOOD QUALITY

How is the safety of machines and systems guaranteed? By using devices which are specially developed to provide protection against hazards in machines and systems. However, safety devices alone will not suffice: they also have to be used correctly. And not just when it comes to their configuration or programming. Safe operation is crucial at a much earlier stage: right at the start of the project. In order to guarantee safe and seamless processes, we need reliable sensors and systems. Even the quality assurance systems that accompany the development and implementation of safety concepts have to be reliable and transparent.

>> As a supplier of devices within the machine and system safety sector, SICK recognized early on that it not only needs to provide high-quality products on a sustainable basis, it also needs a quality assurance system for developing and producing safety components. The same also applies for the development and implementation of safety concepts for machines and systems. As a service provider and partner to manufacturers, system integrators, and operators of machines and systems, SICK has developed a system that guarantees the reliable, verifiable, and transparent delivery of safety services across the entire development and implementation process. And that is not all: the approach to securing the required qualifications for processes and documentation has already been officially certified.

Expert services with safety guaranteed

SICK offers a comprehensive portfolio of services. This ranges from risk assessment, to the preparation of generic safety concepts, through to the specific selection of components, their integration into the system, and programming/configuration. To prove that such measures also meet requirements, SICK safety experts validate the protective functions and support the conformity assessment for the machine/system. Whether for construction, renovation, or linking machines and systems, SICK's services take the strain off customers' internal resources, and enable them to handle more projects in the same time period: ultimately achieving their goals faster and with added safety. SICK's experts have – and can demonstrate – the necessary qualifications, and are always up to date in terms of technological developments, the applicable standards and regulations, and the activities of associations and committees in the field of machine and system safety. These qualifications are regularly checked and documented.

VERIFIED SAFETY stands for processes that meet the highest quality standards when developing and implementing safety concepts

The seal of quality

So that users know straight away that the development and documentation of the high demands of SICK's quality management system are sufficient, the documents produced during development and implementation bear the VERIFIED SAFETY quality seal. This stands for:

- Safety – functional and legally secure
- Reliability – sustainable assurance of processes and competences
- Traceability – fully documented from start to finish
- Transparency – globally uniform, accessible at all times

In this way, each user can immediately see that the documents meet the requirements for technical documentation, and that results will be reliable and traceable from the customer right through to the machine operator. SICK archives all documents, and using the VERIFIED SAFETY number, all documents can be retrieved at the touch of a button.

Safety at all levels

The quality assurance system from SICK offers safety at all levels. Primarily, defined processes and competency management are used to guarantee that risk minimization requirements are met. At the same time, however, the system also offers legal security in that it integrates and demonstrably meets legal re-

quirements. Furthermore, standards are set using a globally uniform approach: Whether in China, the USA, Italy or any other country in which SICK operates, the documentation of results is carried out in a globally uniform manner, and, of course, with regard to the respective applicable standards and regulations in each case. Particularly in companies that operate on a global scale, this produces comparable results and a uniform overview – and not just internally. Generally speaking, multiple contractors and subcontractors tend to be involved in fitting out manufacturing plants. It is ideal if everyone is on the same page.

Projects under control, right from the word go

All management systems used for projects at SICK follow the same standard and consistent management philosophy. Regardless of whether it is an internal development project or a project for a customer, all projects follow a defined process from acquisition through to customer approval. Regular checks against milestones guarantee completeness, reveal any deviations early on, and enable corrective measures to be introduced promptly. Professional and standardized project management is the basis for successful planning, economic implementation, and precise control of projects. Proper management of risks, compliance with cost objectives, and prompt delivery ultimately guarantee the greatest possible level of customer satisfaction.

An integral component of customer project management

The VERIFIED SAFETY quality assurance system forms part of the comprehensive customer project management process and is applied as standard at all SICK locations. Projects such as the retrofitting of protective measures can therefore be carried out at 16 production plants in 14 countries to the same standard as a retrofitting on a single production line in a single country.

The VERIFIED SAFETY process stretches beyond the boundaries of SICK: in many cases, customers prefer local suppliers when it comes to providing control cabinets and installing the devices. If desired, SICK can integrate these partners – or even the customers themselves – into the process chain. In this way, quality assurance remains consistent, comprehensible, and transparent right through to the project's completion.

Certified in accordance with Annex X of the Machinery Directive 2006/42/EC

In the context of comprehensive quality assurance in accordance with Annex X of the Machinery Directive, the components of VERIFIED SAFETY (sustainable competence assurance, consistent processes, full and standardized documentation) were checked and certified by the Institute for Occupational Health and Safety of the German Social Accident Insurance (IFA). The customer can therefore be sure of the quality of processes and documents. Furthermore, SICK is now officially entitled to carry out EC conformity tests for prefabricated safety systems.

VERIFIED SAFETY from SICK: the quality seal it is safe to trust

The VERIFIED SAFETY quality seal represents uniform and consistently high quality of working methods and processes. In this way, users can immediately tell that the documents meet SICK's high quality requirements, resulting in safe, functional, and legally secure working results. This builds trust, and makes SICK a partner to be counted on. *(ro)*

safetyPLUS® – Safe machinery and more

safetyPLUS® is the range of machine safety products and services provided by SICK for the protection of people and investments. The PLUS means comprehensive, individual support for our customers regarding the functional safety of their machines and systems. Comprehensive means optimum support from development of the machine through to the commissioning and use, all the way to retrofitting and modernizing — all over the world. In a bid to meet our customers' requirements for legal compliance and reliable production:

- We provide safety products and systems, services, training, and tools.
- We share our knowledge through personal consultancy services as well as publishing information online.
- We have developed safety tools to make the engineering process even easier.
- We offer functionality to support production efficiency.

Visit us online:
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