

: FOCUS GREEN EFFICIENCY

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INTELLIGENT SENSORS FOR
ENVIRONMENTALLY FRIENDLY SOLUTIONS



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ENVIRONMENTALLY FRIENDLY



Dear readers,

From production and logistics to emissions monitoring and energy recovery, intelligent SICK sensors can be found in every kind of application. They provide important data that makes it possible to use resources more efficiently and counteract hazards to people and the environment. Our sensors are the sensory organs that guide machines and systems, helping industrial facilities maintain sustainable working practices. Thanks to the intelligence they offer, they can be used in a whole host of solutions for optimizing processes and saving energy.

We are tasked with selecting precisely those solutions that best meet the needs of our customers. That's why we work closely with our customers, harnessing a spirit of collaboration to develop concepts that meet their requirements in a way that avoids wasting resources. And very often, it is the small steps that have a significant impact. This edition is packed full of examples of how we have managed to deliver successfully on this task. Our world's natural resources are finite, after all, and climate change is continuing apace, meaning that sustainable business practices are a challenge that we urgently need to face. Our hope is to use the opportunities that sensor intelligence affords to do our part in overcoming this challenge.

Both fascinating and surprising is the fact that our company founder, Dr. Erwin Sick, was making efforts even in his time to raise the profile of this issue. Protecting the environment against the effects of industrial waste gases was a passion of his, and it was for this reason that he developed the very first flue gas density meter over 50 years ago – at a time when conservation of the environment was barely on the public agenda. In doing so, he laid the foundations for our process automation division as we know it now.

Still today, our company is firmly anchored by Dr. Erwin Sick's philosophy that the problems of the future should be challenged in the present day. Indeed, the value we place on future-proof, sustainable development goes hand in hand with our desire to maintain our entrepreneurial spirit. As a result, climate protection and environmental conservation are an integral part of our corporate culture, informing our strategic decisions and shaping our business processes. At the end of this edition, you'll find an illustrative overview of what this means for us in practice.

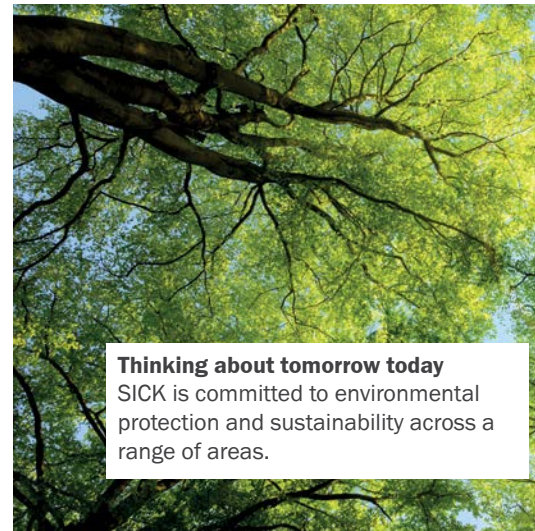
Happy reading! Best regards,

Reinhard Bösl
Executive Board Member Systems & Industries, SICK AG



Maritime emission monitoring

Environmentally friendly thanks to flue gas scrubbing and gas analysis. Stack emissions play a key role.



Thinking about tomorrow today
SICK is committed to environmental protection and sustainability across a range of areas.

WITH INTELLIGENT SENSORS



Sustainable production

Making a valuable contribution to protecting the environment with products: manifold possibilities for a more sustainable production.



18

NOx measurement in China
SICK has captured the Chinese power plant market with its first class measurement technology.



36

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ENVIRONMENTALLY FRIENDLY WITH INTELLIGENT SENSORS

GREATER EFFICIENCY FOR A CLEAN ENVIRONMENT.

You only need to look at SICK's company history to see that environmental protection and sustainable resource management are not simply a passing phase: Company founder Erwin Sick was set on protecting the environment from day one and it wasn't long until he started to develop sensors for measuring the level of dust in industrial chimneys. Fast forward to today and sensors are making an invaluable contribution toward finding environmentally friendly solutions. They deliver convincingly low energy consumption levels but also, by virtue of their reliability and intelligence, have the potential to optimize processes in machines and systems and thereby save gigantic amounts of energy and resources.

PRODUCTION

SICK's intelligent sensors help to save energy, resources, and materials as early as the production stage. They also provide the data required to create more transparency, which is absolutely essential for optimizing production processes.



1

ENERGY GENERATION

Whether it's renewable energies, the production of gas from organic biomass, or power-to-gas, new ways of generating energy pose particular challenges for measuring technology. With its various analyzers and gas meters, SICK is playing an active role in this respect.



4

TRANSPORT / LOGISTICS

For optimal utilization of load bay space: With SICK's volume measuring systems, all types of packages can be measured quickly and accurately. The Package Analytics software prepares a wealth of data in a way that allows the right decisions to be made regarding greater efficiency.



2

EMISSIONS / CLIMATE PROTECTION

Among their many functions, SICK's analysis systems ensure reliable monitoring of exhaust gases and pollutants in power plants, cement works, and waste incineration plants. Pollutant emissions are reduced as a result of optimizing process parameters.



3

RESPONSIBILITY



5

SUSTAINABLE PRODUCTION

SUSTAINABILITY DRIVES INNOVATIONS

SICK doesn't just offer products – it also offers the expertise and high standards required for these products to make a valuable contribution to protecting the environment on a worldwide scale. In this respect, it's the countless little ideas and developments that arise from working closely with our customers to come up with solutions in different applications that really make a difference. These innovations serve to show the many possibilities offered by sensors in production processes alone when it comes to sustainability.

>> Greater efficiency and better quality in packaging processes thanks to controllable, sustainable, and trouble-free production around the clock: The DeltaPac is perfectly capable of differentiating between objects in a continuous flow of materials. Mechanical singulation and packaging buffers between two machine components are not required. The DeltaPac allows you to wave goodbye to many of the issues commonly found in packaging processes, including collisions and product blockages arising due to fallen packages, incorrect alignment of labels or drinking straw applicators, inaccurate packaging group allocations, and deviations in quantities on pallets.





Saving material in the label application process

In the label application process, SICK employs a new kind of technology in the form of the markless sensor ML20. The special feature of this is that the sensor used to position the labels is able to function without the colored marks normally required, offering a saving of up to 5 percent on materials for each label. In mass applications within the packaging industry, that means that up to 1.5 million meters of label material can be saved annually on each system.

Technical innovations reduce cable requirements by half

With the HIPERFACE DSL® digital interface, SICK has developed a purely digital protocol that uses a minimum of connection cables between the frequency converter and motor feedback system. This “digital servo link” interface enables an entirely new architecture for servo drive

systems with completely new options, as it is now purely digital instead of hybrid (analog/digital). In motor-controller communication applications, the cost and effort of cabling is reduced by half. As far as the packaging sector is concerned, the size of this innovation is particularly clear: For around 300,000 servo drives that are installed in packaging machines every year with an average motor cable length of 5 m, HIPERFACE DSL® saves approximately 1.5 million meters of cable.

Motor feedback systems for controlled drives

Market research conducted by Quest TechnoMarketing suggests that the use of electronic – particularly controlled – drives in machines will increase significantly until 2016. In addition to a rise in functionality, the higher levels of energy efficiency associated with controlled electronic drives in particular is a key

factor for this trend. With today's energy prices, the potential savings to be made by using controlled drives and efficient motors can generally be seen in under two years – and in most cases significantly earlier. The effects on the environment are positive: Savings of 135 billion kWh and 63 million tons of carbon dioxide (CO₂) are expected across the EU by the year 2020 as a result of using more efficient electric motors. SICK plays an active role in supporting this positive development with its motor feedback systems, which are specially adapted to suit synchronous motors. (tm)

OPTIMIZING MANUFACTURING PROCESSES IN THE STEEL INDUSTRY

BONUS POINTS FOR THE ENVIRONMENT AND PRODUCTION



When it comes to achieving climate protection objectives or making fundamental improvements to our operational performance, there are many aspects to analyze and evaluate. The approaches to this are particularly wide-ranging within the manufacturing industry.

>> It's not simply a question of reducing emissions. The efficient use of energy, materials and substances, water consumption, increasing waste and wastewater, and stresses on the ground all provide scope for economic opportunities. And when it comes to maintaining high levels of product quality, modern measuring technology goes even further. The opportunities to strengthen individual positions can even be found in the steel industry. SICK's intelligent sensors provide support at various measuring points in a wide range of production processes, so let's take a moment to look at these in more detail.

Optimized melting processes reduce costs

Electric arc furnaces (EAF) use powerful electric arcs used to melt down steel scrap, producing a range of basic construction alloys right through to special alloyed steel. The melting process begins at room temperature. The furnace is predominantly heated with electrical energy via electrodes, although limestone, powder activated carbon, lump coal, oxygen, natural gas or oil are also used in the melting process. In these cases, it is crucial to monitor the exhaust gas emissions. CO, CO₂, O₂, H₂O, and H₂ all provide information not only about the melting process, but also the efficiency with which the materials are being used. Take oxygen, for example: A high oxygen content indicates that the flow of unwanted ambient air in the furnace or exhaust gas system is too high. This in turn causes the electrical energy consumption and use of coal, oxygen, or limestone to increase. If the CO content is too high, this suggests that too much coal or too little oxygen is being supplied. It's the successful interplay between each step that makes all the difference. Once that's been established, production costs can start to drop while productivity increases. And to keep the climate footprint on an even keel, carbon dioxide emissions have to be kept to a minimum. All in all, it is fair to say that exhaust gas analyses on electric arc furnaces optimize the melting process. SICK takes measurements here using hot and cold extraction technologies.

Sensor solutions avoid the production of scrap in rolling mills

Hot billets or slabs are used in rolling mills not only to form to rods, wires, brackets or sections, but also metal sheets or plates. All in just a few seconds – up to 360 km/h. The quality of the products is always paramount – as well as the precise lengths specified by the customer or depending on the next step of the process. If the rods are too short, they're scrap. If they are too long, they have to be processed further. Even the section that gets cut off is scrap. This is a costly piece of waste, as heat energy, working time and raw materials have all been “processed” at various stages along the way. With SICK sensor technology, this waste can be kept to a minimum, as photoelectric sensors, encoders, and other devices are put into place to suit the respective application. Laser scanners position slabs, for example, to minimize damage incurred in the flow path, while distance sensors measure the thickness of coils, the diameter of blocks, and even determine the length of cut sections. All of these devices work together quickly and accurately to keep the entire process under control and thereby improve the level of cutting precision.

Sensors optimize electrical energy consumption in exhaust gas systems

Exhaust gas systems are among the biggest energy guzzlers found in steel

plants. Many of these systems are considerably older than the actual steel production facilities themselves and are therefore extremely limited in terms of their monitoring capacity. This leads to the situation in which the exhaust gas systems always have to run at full blast for the steel production process to function properly. The time, place, and level of extraction has to be determined and monitored around the clock, and the required level of exhaust gas is controlled by means of dampers and/or fans. The energy consumption must be monitored and kept to a minimum without affecting the performance of the entire system. For this to be possible, the measuring technology in use has to be absolutely perfect. The FLOWSIC100 takes accurate flow rate measurements, which enables optimum control of exhaust dampers and fans. It is a rugged device that creates no drop in pressure within the conduit system. Multiturn or singleturn absolute encoders and incremental encoders are responsible for taking speed measurements for monitoring and controlling the main fans. This requires the use of technology with the highest levels of up time that is not only simple and stable, but also precise. The combination of both measurements optimizes electrical energy consumption in exhaust gas systems and provides the finishing touch when it comes to process optimization. (sh)



GREEN LOGISTICS ARE PAYING OFF

INTELLIGENT SENSORS MAKE LOGISTICS PROCESSES EFFICIENT AND SUSTAINABLE



Supply chains and logistics processes form a key component of the value added chains of many industry sectors and fields. Just as it does for economic development, the logistics sector also plays a key strategic role in reducing the level of CO₂ emissions. Many initiatives have already been launched, although solutions with low CO₂ emissions and alternative transport options are not yet available on a wider scale. In this respect, intelligent sensor solutions can make a significant contribution.

>> Protecting the environment can be worth it. Various initiatives by large logistics companies are already demonstrating that the efforts involved in reducing CO₂ emissions are also having an impact on improving cost structure. An important starting point for these efforts is for processes and sequences to be controlled with the greatest precision in both intralogistics and interlogistics. In this regard, intelligent sensors are capable of providing the necessary information accurately and reliably. But this alone is not enough. The flood of data collected must also be capable of being controlled, analyzed in a meaningful way, and evaluated in order to make informed decisions.

Optimizing transport volumes

Today, more than 5.5 percent of the world's greenhouse gas emissions are



caused by logistics alone. In the fields of both transportation and intralogistics, there is significant potential to reduce the level of CO₂ emissions. As a

result, greenhouse gas emissions can, for example, be reduced by an increase in transport efficiency or a reduction in transport volume.



Photo: © erikdegraaf - Fotolia.com

Volume measurement systems from SICK can quickly and accurately measure parcels of any size and in any location, whether they're on the conveying system or – in the case of large objects – directly on the pallet. Combined volume measurement and identification systems make it possible to achieve optimum utilization of load bay space. In logistics environments, these systems are used to calculate transport capacities and optimize vehicle loading. In this way, loading capacity increases and further improvements can be made to route planning. Concepts such as these not only save on transport costs, but also lead to reductions in CO₂ emissions. What's more, the fully automatic volume measurement data provides the criteria that are essential when it comes to making potential process improvements. Once collected, the data has an influence on statistics, for example, which form the basis for optimizing internal flows of goods. For one of the largest logistics service providers in Germany, SICK has developed a globally unique combined volume measurement and identification system that

can be used to achieve optimum utilization of load bay space. The company has set itself a target to cut its CO₂ emissions by more than half by 2020 through the use of this technology alongside additional measures.

Lower energy consumption – even on a small scale

SICK's ZoneControl® solutions make a real contribution to producing more efficient materials handling processes in intralogistics environments. Just as traffic lights regulate the flow of traffic in towns and cities, these solutions control the flow of products on a belt – without the need for a PLC or another type of external control. For ZoneControl® sensors with integrated sleep function, the motorized roller is automatically switched to standby mode if an object is not detected within a set period of time. Furthermore, the new R/IR sensors reduce consumption by 3 percent, placing them right at the forefront of the market.

When it comes to logistics, storage and cargo space are valuable resources. Integrated monitoring solutions offer scope to adapt ongoing processes and even free up space in real time – not only in the warehouse, but also in cargo bays. Sensors are on hand to provide the necessary data, although the data alone is not yet enough.

Making the right decisions by controlling the flood of data

Intelligent sensors record and communicate data, but there's no real added value involved until this data can be used to make decisions on ways to improve processes. "Big data" has become a real issue for companies, particularly in logistics environments where plants are tasked with processing millions of packages each day. On the one hand, this data offers great opportunities; on the other hand, however, the process of preparing it in a way that allows companies to make the right decisions presents a significant challenge. This is why we created the Package Analytics software, which calls upon our extensive practical experience with automatic identification resources to provide a solution for these data recording and analysis requirements. This software allows you to retrieve and analyze information on system performance as well as the statuses of all recorded data with ease –

from an individual package on the conveyor belt to an overview of the millions transported each day. This provides operators with direct access to the key variables for the materials flow, allowing them to understand and control these variables in a more appropriate way. The dynamic database solution simplifies the processes of monitoring, analyzing, and creating reports, images or videos of the packages. It can also be prefiltered and analyzed with ease in line with pre-defined selection criteria. (ae)

IS CLIMATE PROTECTION REALLY ACHIEVABLE?

The majority of climatologists are convinced that the atmosphere is heating up as a result of CO₂ emissions that we ourselves have created. They are keen to assert, however, that we can limit the rise in temperature by emitting less CO₂ from fossil fuels on a worldwide scale. But doubt still remains over whether the “two-degree target” is actually achievable. That said, the combination of idealism, climate and environmental legislation, cost pressure, and incentives has resulted in outstanding improvements and innovations. Today, “old” industries can operate in a significantly more environmentally friendly way, while “new” climate neutral processes are gaining ground.

>> It has been possible to document these rising temperatures thanks in no small part to modern measuring technology: The atmosphere contains just under 40 percent more carbon dioxide (380 ppm) today than the average level across the ten thousand years prior to the age of industrialization. Anthropogenic emissions only constitute around 3 percent of the total rise in CO₂ of approximately 750 gigatons. However, in nature's balanced CO₂ cycle, researchers actually see this as the decisive fac-

tor that causes the atmospheric heating process to speed up considerably. Even methane, laughing gas, sulfur hexafluoride, and fluorinated hydrocarbons are classed as “greenhouse gases”. The anticipated temperature increase by 2050 is at least one degree, rising to up to 6 degrees Celsius by 2100. This is expected to result in more weather damage, famines, social unrest, and migration. So can we slow these climate changes down? It's difficult to say. In any case, we can't say for certain whether,

when, and the extent to which the measures we take to alleviate the anticipated rise in temperature will take effect. Other factors that affect the global climate include the sun, water vapor, and volcanos. What is certain, however, is that the guidelines and legislation on protecting the environment have created a new investment climate on a worldwide scale. A wide range of new projects have been brought to the fore – some of which have seen great success.

The Montreal Protocol bans the use of substances that are responsible for ozone depletion.

1987

The EU commits to the “two-degree target”, whereby the atmospheric temperature should not increase by more than two degrees compared to the pre-industrial era. By 2010, this was accepted by most member states.

1996

CLIMATE PROTECTION MILESTONES

1991

Germany adopts its law on feeding electricity into the grid – the “Stromeinspeisungsgesetz” (StrEG): Power from renewable sources receives financial support for the first time. Since 2000, this has been redeveloped as the German Renewable Energy Act (“Erneuerbares-Energien-Gesetz” – EEG).

1997

The United Nations sets up binding obligations for developed countries as part of the Kyoto Protocol, which was drawn up to reduce greenhouse gases by five percent each year until 2012 based on the level of emissions in 1990 (in force since 2005, extended in 2012). The Clean Development Mechanism (CDM) recognizes the investments made by developed countries to reduce emissions in developing countries.



Fresh opportunities

In recent years, new concepts, processes, and technologies have promoted significantly more economical and energy-efficient production. A lot of these have actually been surprising: Modern coal-fired power plants, for example, are achieving exceptional levels of efficiency and are becoming increasingly easier to control. Thanks to waste incineration, waste heat utilization, and digester gas utilization, it is virtually possible to recycle energy several times. The sun, wind, water, wood, plants, and algae all serve to supply energy in farms and other facilities. Electrolysis that converts wind power into gas could provide the solution to the problem of storage. And perhaps even coal could make an unexpected comeback as a “renewable” raw material from now on, as it can now be made from biomass in an accelerated process. The once ostracized carbon dioxide could also play a key role both in storing gas from renewable energy and for new synthetic products, as long as it doesn't escape into the atmosphere.

Fossils remain at the heart

CO₂ neutral energy sources and materials can revolutionize the economy. Exciting new projects are already underway, but it will still be a few years before they really catch on. For the moment, fossil resources are still at the heart of energy and industrial production in the majority of countries. Therefore, most carbon dioxide can be saved at present through modernization processes and greater energy efficiency.

At SICK, the contribution we make to improving the climate comes in the form of modern yet resilient sensors, analyzers, and complete systems. This state-of-the-art equipment is used around the world in all energy-intensive sectors and facilities. We ensure that your facilities meet even the most demanding requirements for measuring emissions, process gases, dust, and flow measurements. (sr)

The European Union Emissions Trading Scheme is introduced. Around 10,000 facility operators in energy-intensive sectors are involved across 31 European states. They are permitted to purchase a limited number of CO₂ “pollution rights” when they exceed specified emission limits. Investments in CO₂-saving processes start to become worthwhile as soon as the certificates become rare and expensive. This reduces the overall level of emissions, which is why the idea was initially successful. However, the raw material prices for fossil fuels have dropped in price. This means that the Emissions Trading Scheme has to be reformulated by creating artificial shortages of certificates and stricter targets. A further consideration could be to expand via cooperation (linking) with similar systems around the world.

As a result of the Fukushima nuclear disaster, several countries decide to phase out nuclear power: Germany (by 2022), Belgium (by 2025), Switzerland (by 2035), and Japan (partially withdrawn).

2003

2011

2008

2011

The EU sets the “20-20-20” climate targets: By 2020, CO₂ emissions should be reduced by 20 percent, while energy efficiency and green electricity are intended to increase by the same value. Talks are currently in progress to strengthen the European greenhouse gas reduction targets to 40 percent by 2030.

The German government adopts a new energy concept: Based on the level recorded in 1990, greenhouse gas emissions should be reduced by 40 percent before 2020, by 55 percent before 2030, by 70 percent before 2040, and by 80 to 95 percent by 2050. The contribution of renewable energies to electricity production (currently around 25 percent) was redefined in the 2013 coalition agreement from 40 to 45 percent in 2025 and from 55 to 60 percent in 2035. The amended 2014 Renewable Energy Act (EEG) implements these objectives.



MARKUS SCAGLIOSO ON THE SUBJECT OF ENVIRONMENTAL AND CLIMATE PROTECTION

“A REAL HOT TOPIC – EVEN IN ASIA”

Markus Scaglioso is Head of Corporate Solution Center Process Automation (PA) at SICK and deals with questions relating to strategic direction. Here, we talk to him about the subject of climate protection.

SICKinsight: Mr. Scaglioso, do you make any personal contribution to protecting the environment?

Markus Scaglioso: My family and I live in a low-energy house, which has a solar thermal installation on the roof and a CO₂ neutral heating system that uses wooden pellets. That said, there's still scope for me to do more – my car, for example, still runs on diesel.

SICKinsight: To what extent has the climate protection policy affected customers?

Markus Scaglioso: You could say that awareness of the issue has developed on a worldwide scale. Even in emerging countries such as China and India, environmental and climate protection is now playing a key role to the extent that it is even a main focus in the Chinese government's latest five-year plan. This is something that no one would have guessed. Saying that, a strong middle class has developed in China, which is increasingly calling for better quality of life and environmental protection. This observation has actually been categorically confirmed by our business partners in the area. As a result of the severe dust pollution within densely populated cities in India, Iran, and Pakistan – some with over a million inhabitants each – a dust emissions trading scheme is being implemented in India that is not dissimilar to the EU CO₂ Trading Scheme. The climate protection policy has actually even transformed once “dirty” industries into real pioneers when it comes to environmental protection.

SICKinsight: What were or are typical problems and questions?

Markus Scaglioso: Customers obviously also see climate protection regulations



from a predominantly practical and commercial point of view. They want to make sure that they are always working within the law in every aspect of their businesses. This does, however, mean that they expect more active support from us as a manufacturer. What they want most of all is a cost-effective, all-round service from a single source to allow them to concentrate on their core business activities.

SICKinsight: Which new challenges or focal points is SICK currently working on?

Markus Scaglioso: Mercury is a hot topic at the moment, and people are talking about its limits and the best technologies all over the world. China is currently in the process of preparing a new directive in this field, which is something that we were actually involved in. Unconventional technologies for avoiding CO₂ emissions are now also on our radar more than ever. Whenever it makes sense for us to do so, we even get involved in pilot projects such as power-to-gas or measuring emissions on ships.

SICKinsight: What do you think the future holds?

Markus Scaglioso: More than anything, we are looking forward to seeing China's next five year plan (laughs)! After all, the Asian market is becoming significantly more important to us. Recent studies predict that this region will constitute almost 70 percent of global consumption in 2048, and wealth acts as a real boost when it comes to people's need for environmental technology. The subject of air pollution offers a great opportunity for using measuring technology on a worldwide scale. According to a recent WHO study, approximately seven million people die from diseases relating to this type of pollution. It is in the best interests of all those involved to reduce this figure to an absolute minimum. The opportunities to do this are at our fingertips.

SICKinsight: What are the latest developments from SICK for your customers to look forward to?

Markus Scaglioso: Definitely the new PowerCEMS50! This is a fantastic standard analyzer system that is not only cost-effective, but also in line with the requirements of our power-plant customers in Germany and Europe. (sr)

USING CO₂ FOR “GREEN” PRODUCTS

CUTTING EMISSIONS: THERE IS ANOTHER WAY

The energy revolution has also brought to light the fact that carbon dioxide is only a bad thing when it is released into the air. If, however, CO₂ is captured and stored, it could make a significant contribution to reducing CO₂ emissions and generating “green” products.

>> Carbon dioxide is the key ingredient in the power-to-gas concept, for example. This technology involves storing renewable energy in the form of synthetic methane gas to provide a combined solution that both reduces CO₂ and allows problematic green power surpluses to be stored. What's more, CO₂ forms part of the process for producing plastics which are free of petroleum. Many methods are currently being tested to supply raw materials for rubber and plastics for a wide range of everyday products such as trainers and disposable tableware. In theory, we could

recover valuable carbon dioxide directly from the air – but there is no way that would be profitable. However, a win-win option would be to separate the CO₂ from the exhaust gas emitted by conventional power stations or industrial plants and to transfer it to a suitable CO₂ recovery process so that the CO₂ can be stored. The recovery process would involve removing most of the carbon dioxide from the flue or exhaust gas by means of a chemical or physical solvent. Around 85 to 90 percent of the CO₂ could be separated in a profitable manner using this method. The separation process in the raw gas/

purified gas is monitored by analyzers and gas flow meters from SICK.

Transporting CO₂ back underground

An affordable way of making a significant reduction to CO₂ emissions may be provided by carbon capture & storage (CCS). Rather than releasing fossil carbon dioxide into the air, it is captured either during the process or before it reaches the chimney and preferably permanently sequestered in layers of the earth that contain salt water. The technology may prove to be particularly attractive for countries such as China or Poland who



produce most of their power from fossil-fuel power stations. With CCS, the oxy-fuel principle only has a relatively small impact on its efficiency. The method has also been trialled successfully at a German testing facility where SICK analyzers were used.

The oxy-fuel principle involves the combustion of carbon dioxide with pure oxygen and recirculated gas. This produces water and carbon dioxide. To ensure that the CO₂ can be stored as efficiently as possible, it must be extremely pure. It passed this test with flying colors: Optimum qualities were achieved thanks to a purity level of up to 99.7 percent. Analyzers from SICK played a key role in this: once the dust had been removed, the MCS100E HW extractive multi-component analyzer system recorded the fluctuating sulfur and CO₂ concentrations in the damp raw gas without any problems, despite the different combustion capacities and fuels used. Following desulfurization, the MKAS multi-component analyzer system with SIDOR then monitored the sulfur dioxide and CO₂ in the purified gas as it was being supplied to the sepa-



ration facility. The FLOWSIC500 gas flow meter ensured that the gas flows were measured precisely. If geological storage is to be used to sequester the CO₂, additional quantitative and qualitative measuring tasks would also be necessary, in particular to identify any leaks.

Giving plants an extra helping of CO₂

Do plants have a maximum limit with respect to the amount of carbon dioxide they can take in during photosynthesis? Algae, a popular raw material for pharmaceutical products and the production of biodiesel, like to be fed plenty of CO₂. Carbon dioxide is a source of nutrients for algae and nitrogen oxides act as a fertilizer. Both are fed back into the natural cycle of materials. At an algae cultivation pilot plant operated by Subitec GmbH and EnBW, exhaust gases from a biomass power station were used and monitored with measuring technology from SICK.

The rate of CO₂ reduction was determined by measuring the difference at the plant's inlet and outlet. The SIDOR extractive NDIR gas analyzer from SICK was used here. If the CO₂ concentrations required for algae to grow are known, the plant can be controlled in an optimum manner. Monitoring the dilution of the exhaust gas with ambient air controls the concentration. The GMS800 gas analyzer with the DEFOR analysis module, which operates based on the UVRAS principle, also tested the extent to which the algae are able to use NO or NO₂ as fertilizer. The associated analyzer system was set up outdoors and with a temperature control system.

Similar to the process used in an industrial greenhouse. Here, tomatoes are also naturally strengthened with carbon

dioxide and small quantities of nitrogen which acts as a fertilizer. SICK's approved MAC800 modular analyzer system controls the process. The supply of NO_x is converted into natural air/nitrogen and water by injecting a reduction agent and using a downstream catalyst in an SCR denitrification plant. Measuring the NO_x with the GMS800 DEFOR helps ensure that the reduction agent is precisely metered and reduced to a minimum. The emissions limits are also reliably monitored. (sr)



Photo: Thomas Ernting for Subitec GmbH



NO_x-MEASUREMENT IN CHINA

COAL-FIRED POWER STATIONS NOW MEET THE NEW ENVIRONMENTAL REGULATIONS

Coal is China's most important source of energy, and harmful emissions must be significantly reduced. SICK has captured the Chinese power plant market with its first class measurement technology.

„Back in 2003, when the equipment was installed in the desulfurization facilities in China, our devices showed what they can do. A customers‘ trust can only be earned through first class technology, reliable measurement performance and close collaboration. That’s why SICK and its application knowledge is greatly appreciated at denitrification facilities as well.“

Li Changyun, General Manager of SICK MAIHAK China.

>> Growth is a double-edged sword. China’s impressive economic growth has resulted in not just an increased prosperity and a better standard of living in the country’s large cities, but unfortunately also increased pollution and health risks and, as a result, discontent among the population. The air in urban centers such as Beijing, Shanghai, Hebei, Henan and Shanxi has become increasingly contaminated. When economic reform and the open-door policy began at the end of the 1970s, the expansion of agriculture was the first item on the agenda. In the mid 1980s, the country set about intensifying the development of its manufacturing industry, with a corresponding rise in energy consumption. It relied heavily on coal for energy generation, without considering the impact this would have on air quality. It was only at the start of the new millennium that China increased its investment in environmental protection and, in 2013, the new head of government, Li Keqiang, declared a “war on pollution” and announced radical new measures. In the same year, around six million cars were taken off the roads due to their exhaust emission levels being too high. The standards for industrial emissions were tightened up drastically: Small, inefficient power plants, known as “boilers”, were decommissioned, whereas larger ones were improved and equipped with the latest gas purification systems. Denitrification – a maximum of 100 mg/m³ of nitric oxides (NO_x) – is one of the most important goals of the People’s Republic’s 12th 5-year plan. In order to maintain this, flue gas must be purified in a denitrification facility.

Denitrification using only rugged measurement technology

Flue gas are purified using selective catalytic reduction (SCR), also known as denitrification. Ammonia (NH₃) is injected into the flue gas and in the catalyzer the nitric oxide (NO_x) compounds react with the NH₃ to produce water (H₂O) and basic nitrogen (N₂), which are both completely harmless substances. To determine the required amount of ammonia, the NO concentrations are accurately measured at both DeNO_x inlet and outlet. Any additional excess ammonia (“ammonia slip”) is measured at the outlet. The measured values give detailed information on the efficiency of the denitrification process, so the DeNO_x facility can be operated efficiently and economically. Tried and tested over many years, SICK’s measurement technology measures these values reliably and with a very high of availability, thus making a significant contribution to keeping airborne pollutants at a low level.

SICK’s GM700 laser gas analyzer measures the NH₃ slip to a high degree of accuracy in the single-digit ppm range. The measuring probe has a special gas-permeable filter that stops dust from

entering the measuring path – essential due to the extremely high dust load in the gas duct. Easy, one-sided installation at a measuring point in the flue saves time and reduces costs. SICK’s SIDOR extractive gas analyzer makes the NO measurement, and its intelligent signal processing and highly resilient detectors deliver very stable measured values. The operators are all very satisfied, as the improved management of the DeNO_x facility also enables them to conserve ammonia resources and prevent the formation of ammonia salts in the facility, which in turn keeps maintenance costs low.

To date, many Chinese coal-fired power plant operators have benefited from SICK’s many years of experience, because all energy providers face enormous challenges. Only a few DeNO_x facilities were installed before 2011. SICK has experience in process measurement and can offer a wide range of technologies as measurement solutions. So far, SICK MAIHAK China, SICK’s Chinese subsidiary, has delivered and installed 800 systems to monitor denitrification facilities in coal-fired power stations. (sh)



REDUCING DUST EMISSIONS

INDIA: DEALING IN FINE PARTICULATES

When it comes to emission levels in our country, the key to meeting the very modern challenge that they present lies in finding innovative approaches for combatting them. In India, particle emissions trading is becoming the standard countermeasure.



>> When it comes to pollution control and emission reduction, aerosols, suspended dust, and fine particulates are three things that can't be overlooked. The smaller the dust particles, the worse the effect on health – and in India, there's a lot of dust. This is why the country took the decision to significantly reduce these emission levels with as little impact on the cost to the national economy as possible. Similar to the European carbon trading scheme, the Indian state institutions are taking an innovative approach to tackle this contemporary challenge: Emission Trading Scheme – Particulate Matter. This pilot scheme is supported

by the UN and will be launched in 2014, starting with the three Indian federal states Gujarat, Tamil Nadu, and Maharashtra. These states are home to the 15 most polluted regions in India. More than 1,000 companies have been chosen to monitor their emissions in these states. According to J. S. Kamayotra (Member Secretary of the Central Pollution Control Board), there are two aspects to consider: "First, the emissions standards for the individual sectors of industry must be defined. Second, it is necessary to ensure that industry actually complies with these standards." Emissions are to be measured continuously to make sure

that the standards are being observed. Detailed regulations have been created to this end, and these even cover aspects such as transferring the emissions data in real time to the authorities.

According to K. Nandakumar, Chairman of the Instrumentation & Automation Division of the Confederation of Indian Industry, the challenge also lies in raising awareness of the issues surrounding environmental protection in industry and putting this knowledge into practice.

Frank Hehl, Head of Process Automation at SICK, stated that exhaust gases must be measured correctly in order for these emission reduction measures to be successful. Given the importance of measured values for emissions trading, all parties involved must ensure that the results they produce are reliable. In Europe, this can be achieved by using measuring instruments that have undergone suitability testing and by continually validating the results using regular comparative measurements.

Chemtrols Industries Ltd.

Chemtrols Industries Ltd. was founded in 1975 and is a SICK partner for process automation solutions in India. Tracing its origins back to process controls in the chemical industry, Chemtrols is now one of the leading solution providers in process analytics, environment and emissions monitoring, flow and terminal automation, process instrumentation, steam engineering, and utility management systems. As a specialized service provider, they cater to various industries, such as cement, steel, oil and gas, energy, fertilizer, and chemicals and petrochemicals.



Photo: Eva Grossert

50 years of dust measurement products at SICK

It all started 50 years ago with the first smoke density measuring device. Since then, SICK has become a respected name all around the globe in the field of dust monitoring. The instruments are built to be extremely reliable, use highly precise optical measuring techniques, and contain components that automatically compensate for errors caused by the installation conditions. All of this results in a high level of measurement accuracy and exceptionally long maintenance intervals. Regardless of the environmental standard being used in the measurement, and whether there is a high or low dust concentration, the measuring conditions are simple or difficult, or the application involves corrosive or hot flue gases, SICK can provide a DUSTHUNTER dust monitor to suit every situation.

The General Manager of NTPC – one of India’s largest power plant operators – has pointed out that smaller and medium-sized operations in particular are heavily dependent on energy that is generated locally using diesel generators. It is here that particle emissions are high, as well as sulfur oxide and nitrogen oxide, in regions that are often densely populated.

The dust emissions trading scheme therefore aims to pinpoint smaller and medium-sized polluters and achieve the best possible results using the limited funding by implementing market-driven reduction measures.

The SICK partner Chemtrols has the knowledge and technical capacity that is needed to provide the best possible support to India’s particulate emissions trading scheme, using complete solutions that incorporate SICK sensor technology. (sh)



MARITIME EMISSIONS MONITORING

FULL SPEED AHEAD: IT PAYS TO PROTECT THE ENVIRONMENT

Environmentally friendly could be the watchword when it comes to the future of emissions on the open seas – thanks to flue gas scrubbing and gas analysis including sensors from SICK.

>> Powering marine vessels: heavy fuel oil as an affordable fuel. Heavy fuel oil is a tar-like by-product of crude oil refining with an extremely high sulfur/heavy metal content. A container ship consumes an average of approx. 50 tons for each day at sea, depending on the

ship's size, load, and how it is operated. Proportional amounts of carbon dioxide, sulfur dioxide, nitrogen oxides, and soot are released out at sea through the stack. Shipping companies could of course fuel their vessels with low-sulfur diesel oil. But that is much more expensive

than heavy fuel oil and the price is continuing to rise. The alternative is to invest in exhaust gas cleaning as well as in better exhaust gas measuring technology and monitoring systems. It is even an area where it is possible to make money: high emissions taxes are eliminated



when emissions values are observed and operating costs can be significantly reduced. This investment in environmental protection pays off in as little as 12 to 18 months, according to a study by Germanischer Lloyd. In surveys, even consumers have claimed that they may be prepared to share these environmental costs. What's wrong with paying an extra 20 cents for a T-shirt from overseas?

Stack emissions play a key role

Practically all of the world's trade is done 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 our roads. The sulfur content in marine fuel is allowed to be up to 3.5 percent – 3,500 times higher than the diesel used in trucks. This is set to change by 2020 at the latest, as the sulfur content will then be limited to 0.5 percent worldwide. For the North Sea, Baltic Sea, and the North American bodies of water, even stricter pollutant regulations will take effect starting in 2015, when the sulfur content will be restricted to 0.1 percent. Compared to other modes of transport, soot emissions are currently still at a level of around 80 percent. It is only with regard to CO₂ emissions for transported goods that marine transport can boast a relatively good record compared to rail, road, or air transport.

Many shipping companies are starting in until they can earn money for implementing environmental protection measures. Business is tough and competition is fierce. A new, medium-sized cargo ship which holds around 10,000 containers costs approximately 100 million US dollars. Without a doubt, it is the fuel that accounts for the lion's share of the operating costs. The additional installation of nitrogen oxide catalytic converters and state-of-the-art soot particle filters costs around 500,000 US dollars. Around 3 to 7 million US dollars have to be spent on a exhaust gas purification system. Peanuts for environmental protection?

Thanks to the new regulations from the International Maritime Organization (IMO), the basis for decision-making for shipping companies and their environ-



mental management has been established for when ships wish to sail in emission control areas in future. MARPOL Annex VI, NTC 2008, and the Exhaust Gas Cleaning Guidelines contain all the information required to minimize the various forms of pollution connected with shipping.

SICK sets a new course

The engineers in the engine room are now also environmental officers. Large ships even employ people specifically to take on this role. They monitor the exhaust gas values and the performance of the scrubbers – large showers where all exhaust gases pass through. SICK devices continuously monitor the concentration of pollutants: SO₂, CO₂, NO, and NO₂ upstream of the scrubber, and SO₂ and CO₂ downstream – always to a high level of accuracy in parts per million

(ppm). High temperatures, stormy seas, and permanent ship vibrations do not compromise the measurement accuracy of the MCS100E MARSIC ship emission measuring device: 20 to 24 ppm of sulfur dioxide in a measuring range of 0 to 150 ppm of SO₂, which corresponds to the permitted sulfur content (equivalent to 0.1 percent of sulfur per kilogram of fuel mass), in a CO₂ measuring range of 0 to 6 vol%. The prescribed emissions values can be observed and documented in line with the requirements – for ports or emission control areas (ECAs), even during the transition phase from heavy fuel oil to low-sulfur marine diesel. These measured values also help to optimize denitrification and desulfurization processes.

Ultimately, the exhaust gas must have the same concentrations as that of a



cleaner fuel. Even the captain benefits from the proven SICK technology and uses it to monitor the performance of the engines.

In addition to the compulsory gases, the MCS100E MARSIC can be expanded to measure additional gases – up to a maximum of 8 components as well as oxygen and total carbon. When low-sulfur natural gas is used as the fuel in marine applications, the analyzer is able to reliably measure methane slip in the exhaust gas – quantities that are lost to the combustion process and are also regarded as greenhouse gases. If the exhaust gas is to be cleaned later on using a catalytic

converter, this is also not a problem for SICK products. The MCS100E MARSIC measures the NH_3 with ease to control the amount of ammonia or urea injected.

As ships can have up to six engines plus auxiliary units and boilers, the emissions measurements should be continuous and reliable, have very stable and long calibration intervals and the measuring technology should not place high demands on the operator, otherwise measuring procedures can quickly become an expensive full-time job. From sample extraction through to the measuring cell, all components of the MCS100E MARSIC that come into

contact with measuring gas are heated above the dew point and thus protected against corrosion. The MCS100E MARSIC makes continuous measurements, only requires maintenance every 6 months, is extremely easy to service, and does not take up much space on board the ship. To maintain high levels of operational safety, SICK has service employees stationed in over 80 countries. Maintenance, spare parts supply, and remote service via the SICK Meeting Point Router are quickly close at hand. In addition to measuring gases, SICK is also an expert in particle measurement on ships, measuring volume flow in exhaust gas ducts, and taking highly pre-

cise flow measurements concerning the consumption of natural gas. SICK offers a broad portfolio consisting of a whole host of technologies for an exceptionally wide range of measuring solutions.

A considered approach to environmental protection

Protecting the environment should not just be a duty. The first advocates of this “green wave” have already taken to the high seas with their clean approach. And now they are no longer faced with additional charges for not complying with the regulations each time they enter a port. They control and monitor their ships' engines in the interest of energy management. And ensure a sense of well-being with low emissions values. This is already happening on ships that use natural gas as their fuel to comply with the IMO limits. The “Containerships VII” is one of the first container ships that champions clean operation and that fully



complies with the environmental documentation requirements. SICK analyzers play a key role here. So what does the team think about the measuring device? “Technology is always good when I don't need to spend extra time seeing to it. When we're at sea, we need things to be reliable,” explains chief engineer Hyvönen in his typically Finnish, extremely practical way.

Already today large passenger ships are sailing in an environmentally friendly way – some even boast emissions values that are below the maximum limits. With their individual environmental management systems, they are always in a position to react quickly to new trends, legal requirements, and improvements. Huge focus is placed on the subject of ecology and a logical approach is taken when it comes to incorporating innovative environmental technology. “This allows us to make our guests and employees feel good,” is the opinion of many tour operators. (sh)

SICK is certified by Germanischer Lloyd (12764-10 HH) and the MCS100E MARSIC can be used for all applications in accordance with section 2.1.2 of the NO_x Technical Code.

Certified for all users

- 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

FIGHTING CONTAMINATION EFFECTIVELY

Water is one of the earth's most valuable resources. Throughout the world, this liquid plays a key role when it comes to supplying the global population as it continues to grow. It is therefore extremely important that we implement sustainable water management strategies to protect the earth's bodies of water and their role as a part of the natural ecosystem, as the basis for human existence, as a habitat for animals and plants, and as a valuable commodity.

>> In industrial systems or chemical parks, organic substances can enter the sewage systems or surface water during filling processes, repairs, or breakdowns. To prevent this, wastewater must be reliably inspected for contamination before it enters rivers or seas. Legal requirements such as the German Federal Water Act (WHG) or corresponding EU directives regulate how bodies of water are protected. Operators of industrial systems want to be sure that they are able to meet these conditions.

Sensors from SICK support the observance of these requirements and make a contribution to keeping the bodies of water clean.

Monitoring levels in transformer stations

As a leading transmission system operator for renewable energy in Europe, Amprion AG operates what at 11,000 km is the longest high-voltage grid between Lower Saxony in Germany, Switzerland, and Austria. This comprises a total of around 160 switching and transformer stations.

Each transformer is erected in a concrete tank in which various liquids such as rainwater or oil are able to collect. In order to prevent the tank from overflowing, for example if there is heavy rainfall, a pump drains the liquid away as soon as a defined maximum level is reached. Conversely, to prevent the pump from running dry, it must be ensured that the level of liquid in the tank does not fall below a minimum level. The particular challenge here was that the medium to be measured consists of liquids that can change at random, such as water or oil.



Redundant level measurement

When it came to this task, SICK was able to win over its customer with a complete solution. Two sensors with different operating principles – the LFP Cubic TDR level sensor and the UM30 ultrasonic sensor take measurements simultane-

ously and can therefore monitor each other. The LFP Cubic is used to take continuous level measurements and to detect limit values of liquids. Depending on the measurement principle, the measurement results are not affected by the properties of the medium. The UM30 is

also used to measure the level in the collection tank. The integrated temperature compensation function, the ability to detect the level of clear or cloudy liquids regardless of their color, the large contamination tolerance, and the large operating temperature range from $-25\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$ guarantee reliable measurements all year round, even under difficult conditions.

This combined solution from SICK prevents liquids from overflowing from the concrete tanks used by transformers, thereby protecting the environment.

Ultrasonic flow measurement in cooling circuits

Evaporation or changing tools in process engineering applications, for example, can cause cooling water to be lost in cooling circuits. When filling with water, chemicals also have to be added so that the cooling water remains stable from a chemical/biological perspective and to prevent damage to the pipes and systems. Irrespective of whether open or closed cooling circuits are used, the addition of chemicals often means working with a large quantity of additives. The

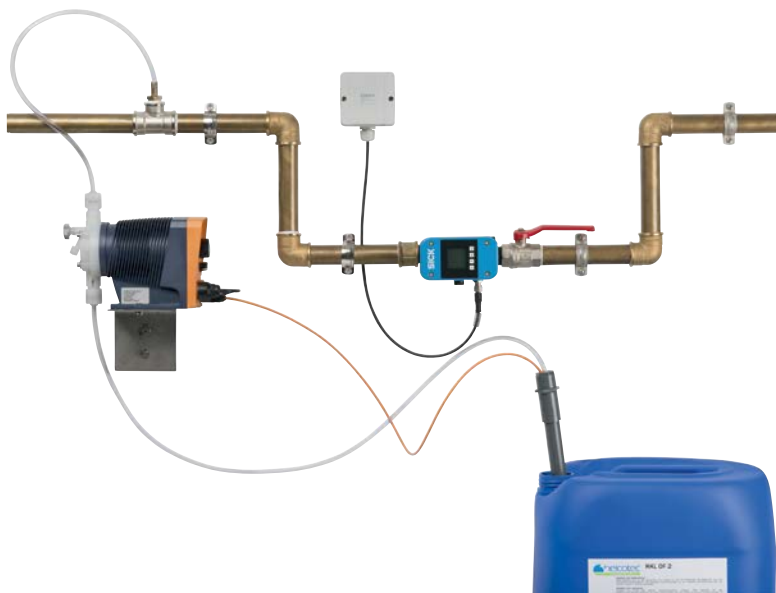
result can be an overdose, which inhibits the required stabilization and protective effects. Companies helcotec and DÜLK & KOSUB have taken up the challenge of working out the optimum dose of additives. helcotec Chemie und Technik GmbH & Co. KG works on the development, production, and sale of additives for cooling circuits. DÜLK & KOSUB Klärsysteme is a plant construction company which specializes in small sewage treatment plants, solutions for the use of rainwater and drainage, as well as separation systems and pumping stations.

A direct benefit for companies and the environment

SICK's FFU ultrasonic flowmeter ensures that the precise amount of cooling liquid supplied to the system is known. The metering pump can then establish the correct cooling water/chemicals ratio and prevent any overdoses from occurring. "The reduction in the amount of additives used doesn't just lower the operating costs of the plant operator, it also benefits the environment," states Roland Schreurs from helcotec.

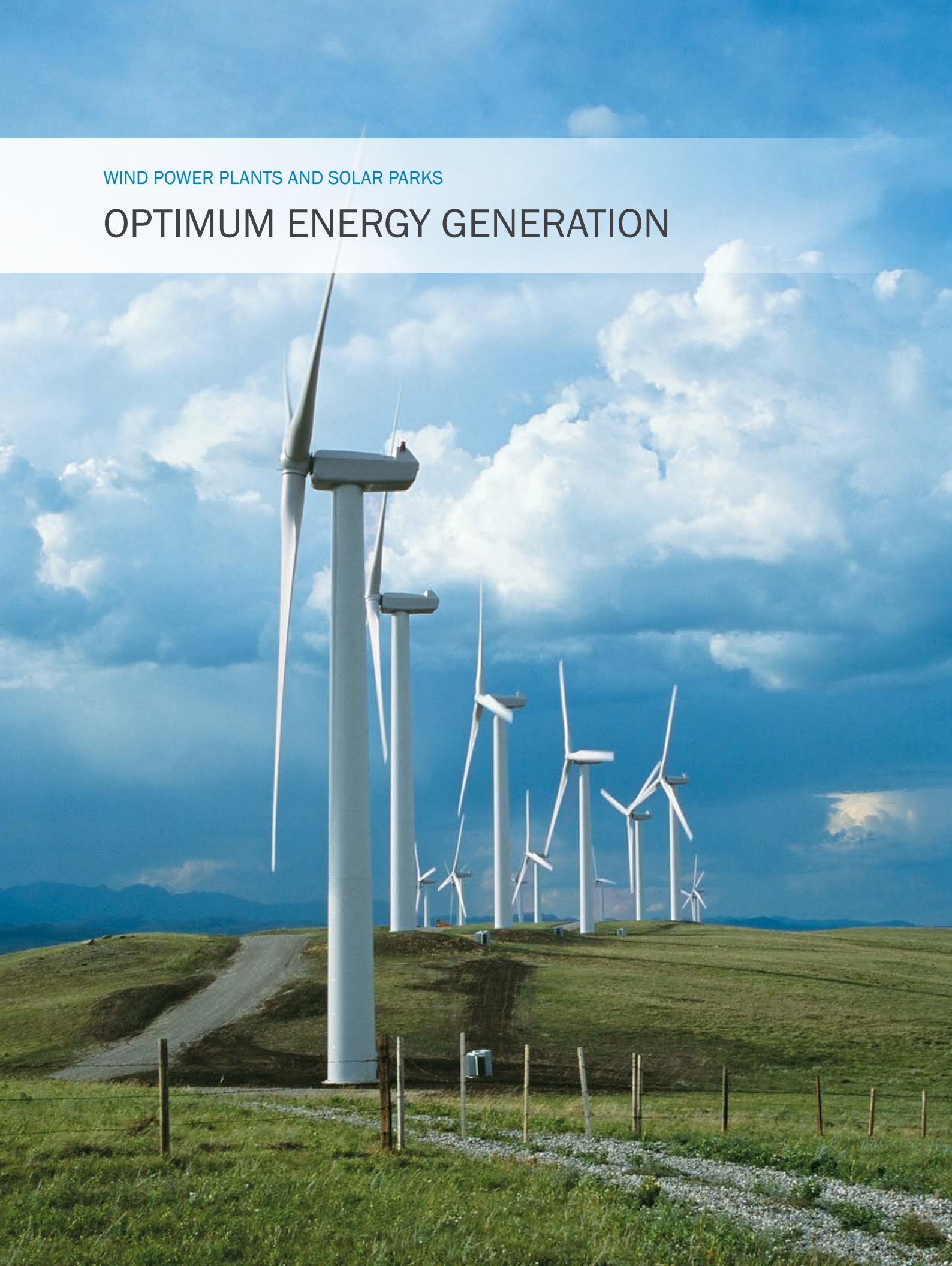
Yet SICK sensors can offer even more when it comes to sustainability. For example, the TOCOR700 extractive total carbon water analyzer continually extracts small samples from the wastewater and inspects it for organic contaminants. Operators can thereby distinguish between wastewater that can be fed directly into watercourses and that which must undergo post-treatment.

Of course, SICK can only make a small contribution to protecting water, the central element of the earth's biospheres. Each individual has a duty to preserve this vital element for future generations. (ir)



WIND POWER PLANTS AND SOLAR PARKS

OPTIMUM ENERGY GENERATION



Wind power plants and solar parks are now an integral part of a sustainable energy management strategy. The wind and the sun are reliable sources of energy: there will always be wind on the earth, regardless of whether the movement of air is converted into electricity or not. The sun will also continue to shine as always, no matter what happens to the energy it supplies. What we really need to ask ourselves is how we can exploit these types of renewable energy as effectively as possible. Sensors from SICK play a role in ensuring that wind power plants and solar parks work efficiently – and, what's more, under very challenging climatic conditions.

>> Wind power plant

Wind power plants generate kinetic energy from the wind. Here, it is the sensors' job to finely adjust the plant's individual components in such a way as to allow the wind to be used as effectively as possible and to generate a maximum amount of energy. The sensors must be adapted to cope with the changing ambient conditions and be highly durable, as replacing them at great height is not an easy task and is also very expensive.

The rotor blades in wind power plants have to be adjusted based on the strength of the wind, as this enables the plant to achieve an optimum level of efficiency. This adjustment is made by absolute encoders with magnetic scanning from SICK, for instance. To track the wind direction, the encoders set the nacelle to the optimum position. This prevents strong winds from causing malfunctions and the downtimes that result. The rotor speed can be measured with incremental encoders. They control and monitor the speed of the rotor.

Encoders from SICK are highly resistant to weather conditions and electrical influences and are also maintenance-free and durable. Magnetic scanning, a rugged housing – enclosure rating IP67 – and the high shock and vibration resistance are ideal to meet the requirements for use in onshore and offshore wind power plants. Whether pitch adjustment, yaw control, or speed monitoring, the fact that more than 20,000 SICK encoders have been installed in pitch-controlled plants clearly demonstrates the expertise that the company has developed by working in this sector for over 10 years.

With this portfolio, SICK meets the requirements of the wind power industry in every way: from application consultation and engineering to continuous operation with minimum downtimes, SICK is there throughout all the development, production, and maintenance processes

of the plant. Customers benefit from application-based solutions that stand out thanks to their efficiency, sustainability, and investment security.

Solar park

In solar parks too, the aim is to use the energy radiated by the sun in an optimum manner. With this in mind, the EAR Group, a major provider of turnkey photovoltaic systems in Italy, is integrating trackers, which align the solar fields to enable them to optimally follow the sun. Two positioning drives align the solar field to the vertical position of the sun, and adapt the field according to the horizontal movement of the sun. These two movements need to be monitored.

The EAR Group found the ideal solution for the detection of the angular change of the solar fields in the DFS60 incremental encoders with through hollow shaft. The sensor has a very high resolution, enabling precise adjustment of the solar fields. To allow the solar fields to absorb as much solar radiation as possible both in summer and in winter, the IME inductive proximity sensor was incorpo-

rated. These sensors allow accurate and non-contact axis angle limitation of the tracker mechanism. They are positioned so that the solar fields can receive the maximum amount of sunlight via the trackers in both winter and summer. The horizontal working angle of the trackers is limited at each end position by an IME sensor and spans 240° from one position to the other. This makes it possible to follow the sun's entire path each day. In actuality, the solar fields rotate over an angle of approximately 120° in winter to around 220° in summer.

The need for the SICK sensors arose from the desire to use the maximum movement of the trackers and simultaneously to ensure an exact placement of the solar installation. This requirement was satisfied in every respect – what's more, under what were sometimes very harsh ambient conditions. (ir)



WHAT CAN WE DO WITH ALL THE GREEN ENERGY?

POWER-TO-GAS STORAGE TECHNOLOGY: ALMOST READY FOR MARKET

Storing green power is a key milestone when it comes to the successful implementation of the energy transition. Converting it into hydrogen or synthetic natural gas is a concept that shows a great deal of promise and involves the stages of water electrolysis, methanation, and feeding the power into the natural gas grid. SICK's involvement relates to gas analysis and the detection of gas flows and consumption rates.

>> A large number of financial incentives are offered for wind and solar power in Europe. The industry has grown very rapidly in Germany: by 2050, the target is to have reduced the amount of CO₂ emitted from fossil fuels by 95 percent compared to 1990. However, the problem is that biopower production fluctuates depending on the weather and is therefore not a reliable source of supply for the industry. As the grid has not been developed and there is a shortage of balancing capacity, the power lines are in danger of being overloaded by surpluses of biopower. Consequently, producers of renewable power have to shut their systems down temporarily or give the surpluses away to neighboring countries. Therefore inten-

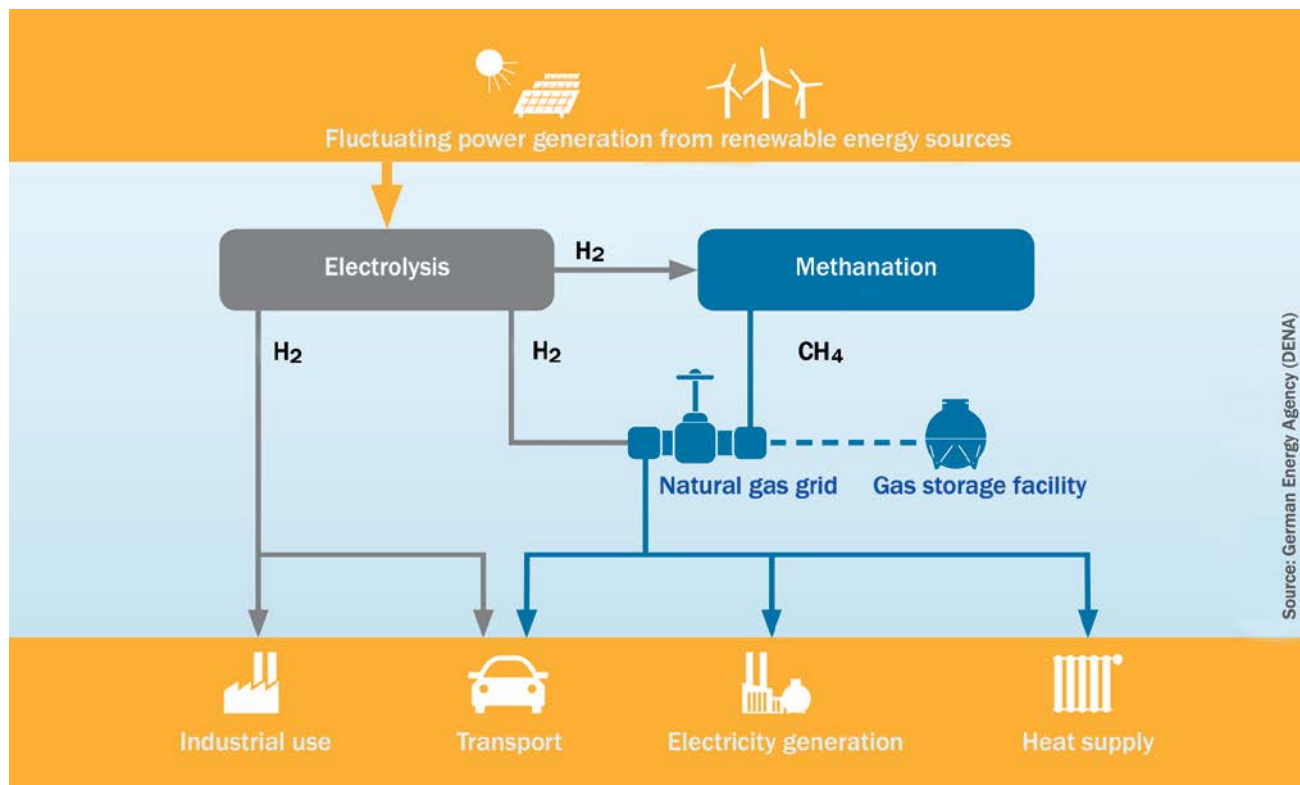
sive research is being carried out into finding good storage options.

Of particular promise is the power-to-gas method, which was developed in 2011 by researchers in Stuttgart and is also well supported in Europe. The technology involves using electrolysis to generate hydrogen from green power. With the aid of separated CO₂, for example from neighboring biogas fermenters, it is processed to form storable synthetic natural gas and can be stored in the German natural gas grid. Alternatively, the hydrogen can also be used in vehicle fuel cells as a drive source. This means that the process is also of interest to car manufacturers. The level of efficiency of meth-

anation has previously been criticized as being too low. However, this could soon be set to significantly improve by means of high-temperature electrolysis at 800 °C and using waste process heat.

SICK and its analyzers are involved at an early stage

There are now over 20 pilot plants which are working on getting power to gas ready for market. SICK is also involved in the development with its range of analyzers and gas flow meters. For example, the purity of the separated CO₂ and the quality of the bio-methane needs to be monitored. In addition the maximum permissible hydrogen content of 5% must be ensured at the natural gas feed-in stations. Ultrasonic gas flow meters such as the FLOWSIC500 enable the gas flows and consumption rates to be precisely monitored and calculated. (sr)



The power-to-gas process: fields of application.

MARKUS HAAS IS THE MAN IN THE KNOW WHEN IT COMES TO POWER-TO-GAS AT SICK:

“I LIKE TO THINK OUTSIDE THE BOX”

For three years, Markus Haas has been driving the subject of power-to-gas forward at SICK – based on a keen sense for and a genuine interest in new technologies. “I like to think outside the box and it had occurred to me that this might be an interesting field for the future, including from a process and exhaust gas analysis perspective,” explains this enterprising engineer, who works in the “Process Automation Solution Center”, predominantly on marine diesel analysis. Thanks to his idealism and commitment to the work in his own time, he succeeded in getting SICK to explore the measuring tasks involved in this industry of the future from a practical point of view. Thanks to Markus Haas, SICK has been participating in the work right from the first analysis devices.

>> How did he come across power-to-gas? “It all started quite mundanely with a piece of direct mail from Badenova, our local energy supplier,” relates Markus Haas cheerfully. “The brochure described an innovative research project with the Fraunhofer Institute which was concerned with the conversion of surplus wind and solar power into storable natural gas.” Intrigued, Markus Haas read more about it on Badenova's home page, where he discovered that the project was still looking for industry partnerships. Haas gave them a call. “Badenova was impressed that someone had actually got in touch off the back of the article,” he laughs. This enabled the SICK engineer to come into contact with DENA, the Germany Energy Agency, which is a government-funded project platform that was set up specifically for energy-related research. There, creditors, scientists, as well as energy, technology, and automotive groups work flat out to turn highly promising storage and energy technology into efficient and profitable options as quickly as possible.

This provided Haas with the opportunity to visit events and pilot plants and demonstrated that SICK was already a well-known name in the sector. Markus Haas himself was fascinated by the new processes and possibilities, but also by the obstacles that were hindering their implementation to a greater or lesser

extent: “The ideal scenario would be to store the energy in the form of hydrogen in the natural gas grid. But as gas mixtures are now only allowed to include a hydrogen content of a maximum of 5 percent, this would mean many gas suppliers having to convert their turbines,” explains Haas, giving one example. “Until the 1980s, a hydrogen content of up to 50 percent was permitted in the natural gas grid.” He also found it astounding that “there was relatively little awareness of the subject of measuring technology.” He also added that hardly any thought had been given to how important precise measured values would be to ensuring a reliable supply and consumption downstream. Markus Haas acquired tender documents and promptly obtained the first small order: The new Thea electrolysis plant, which feeds hydrogen into Frankfurt's energy grid, uses a SICK hydrogen meter.

Achieving a practical balance between ecology and cost advantages has always



been of interest to Markus Haas. His house has thermal insulation, rainwater is collected via a tank, and the roof of the family home has been used for many years to generate solar power. The family then sells this power to their electricity supplier and they invest the money they make in the future of their two children. The Haas family currently only uses a portion of the green power they produce themselves.

In the future, Markus Haas would like to be fully self-sufficient: “But there aren't any suitable energy storage systems for the home just yet,” he adds with some disappointment. Despite the obstacles that are currently in its way, he is convinced that power-to-gas could be an excellent storage solution for the energy transition. In the meantime, he is making sure that his 17 and 19-year-old children are aware of the issue. He succeeds in this by focusing on what matters to them and their peers: “The aspect that they really connect with is that the storage of wind power could enable them to fill up their cars in a way that is CO₂-neutral.”

“It all started quite mundanely with a piece of direct mail from our local energy supplier”.



ENERGY AS A WASTE PRODUCT

TURNING GARBAGE INTO REVENUE

Garbage that is burned and converted into power, district heat, and ash releases significantly fewer climate-damaging gases than garbage deposited in landfills. However, the practice of thermal recycling (which converts waste into energy) is also booming because, all over the world, there is an increasing amount of garbage and less landfill space. Across the globe, approximately 230 waste-to-energy plants will soon be added to the 2,200 or so that are currently in operation. The aim is to achieve greater efficiency, lower costs, and reduced CO₂ emissions through metal recycling, ash treatment, and waste heat recovery. Continuous measuring technology helps to determine efficiency reserves.

>> In most cases, garbage is burned on furnace grates at approximately 850°C or by means of fluidized bed combustion after prior treatment. In addition to carbon dioxide, these processes produce a number of other dangerous pollutants, such as carbon monoxide, sulfur dioxide, nitric oxide, hydrochloric acid, hydrofluoric acid, mercury, dust containing heavy metals, and highly toxic substances. Furthermore, non-homogenous waste fractions burn at different rates, clog up plant sections, and can quickly change the flue gas composition. Therefore, measuring technology that is both very reliable and highly sensitive is in-

dispensable, as it provides accurate information on crucial plant parameters.

One of Sweden's most state-of-the-art waste incineration plant *Tekniska Verken*, for example, is required to measure pollutants continually and produce reports for the authorities on a regular basis. The plant uses more than 420,000 tonnes of household garbage to create heating and cooling energy, and has an energy efficiency rate of > 60%. To monitor processes and pollutants, the operator uses the SICK MCS100E infrared multi-component measuring system, whose features include integrated O₂ and total carbon

measurement as well as in-situ dust measurement and non-contact ultrasonic volume flow rate measurement.

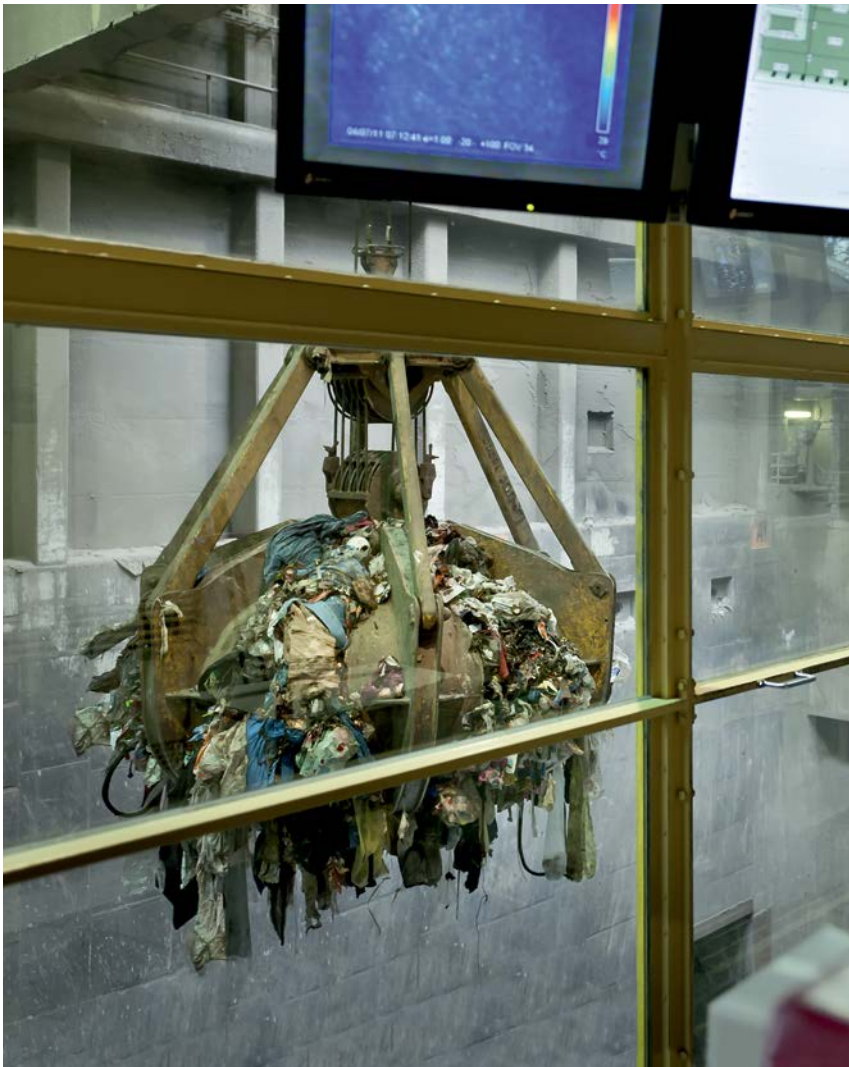
The MCS100E can simultaneously measure approximately eight pollutants and informs the operator of increases in levels well in advance when measuring untreated gases, thus ensuring that there is enough time to implement countermeasures in the gas cleaning stages. In addition, it saves on calibration gas costs, as the calibrated measuring ranges are checked by swiveling optical filters. The plant management has a redundant back-up system running too, to ensure that no



half-hourly values are lost and that failures are avoided. If implausible measured values arise – something that is not uncommon in the fluctuating emissions values experienced in waste incineration plants – this back-up system also serves to validate the measured pollutant concentrations.

The largest waste-to-energy plant in the Swiss canton of Valais, the SATOM WtE plant in Monthey, also uses a SICK multi-component device: the MCS100FT, which has integrated HF monitoring and is based on the Fourier transform measurement principle. In its former life the plant simply destroyed waste, but nowadays it produces metals and energy. Every year, it generates approximately 140 million kWh of electricity and 100,000 tonnes of process steam from around 160,000 tons of municipal waste and 40,000 tons of scrap wood. The 27,000 residents of the neighboring communities receive heat supplied by a dedicated district heating network.

The WtE plant has been publically acknowledged for its particularly good carbon footprint and the high level of waste it recycles. A self-controlling infrared spectrometer from SICK supplies the measured values for this. It monitors the exhaust gas components hydrogen chloride (HCl), ammonia (NH₃), carbon monoxide (CO), sulfur dioxide (SO₂), nitric oxide (NO), nitric dioxide (NO₂), carbon dioxide (CO₂), and trace amounts of hydrofluoric acid (HF) directly in the chimney. Thanks to the anti-corrosion measurement cell and wear-free ejector, the measuring system achieves a gas flow rate of 400 l/h. The MEAC2000 data acquisition system incorporated into the emission measuring system continually records all incoming values and standardizes all measurements to the legally prescribed O₂ reference value of 11% by O₂ volume. All data is continually transferred to the WtE plant control system as hourly and daily average values.





ASSOCIATED PETROLEUM GAS MEASUREMENT IN RUSSIA PUTTING AN END TO WASTE

With the production of oil, the Russian government has recognized the potential to enhance its environmental protection credentials and improve energy efficiency. This also includes making good use of the associated petroleum gas (APG) that is a by-product of oil production. The complex measurement of the APG flow rate which is also required from a legal perspective is a task that the SICK FLOWSIC100 Flare is able to undertake, and under the most challenging weather and gas conditions.

>> Drilling for oil generally produces gas, either as bubbles or dissolved in the oil. This associated petroleum gas is predominantly made up of methane, is rich in energy, and is often flared. 400 million tons of CO₂ were released into the air this way in 2010. Methane can also be emitted here and is much more damaging to the environment than carbon dioxide. Valuable energy is also discharged. Based on the more than 150 billion m³ of associated petroleum gas that is currently burnt off, this amounts to more than 30 billion US dollars or 30 percent of the EU's energy consumption each year. Converting the gas into natural gas and using it to generate energy would make much more sense. In Russia, this has long since stopped being simply a side issue. The environment ministry has set the target for companies working with natural resources,

of burning no more than 5 percent of the associated petroleum gas that is produced. The deadline for meeting this target expired in 2012. Russian oil and chemical companies are continuing to work intensively on programs which would enable almost 60 billion m³ of associated petroleum gas to be processed every year. Why is it proving so difficult to implement the regulation? It is partly due to the lack of access to gas pipeline networks, to storage facilities that are either non-existent or too small, or to not having sufficient processing capacity. In many cases, transporting the gas hundreds of kilometers across this sparsely populated country is also simply unprofitable. Currently, the volume quota that is compliant with the regulations officially stands at around 75 percent of the associated petroleum gas used. The Russian government

has taken a great step forward with its efforts. What's more, the oil companies have announced a high level of investment up to 2014 for the construction of pumping stations, gas storage facilities, pipelines, and gas power stations. The incentive for these investments comes from the high penalties that are handed out if the quota is not met. What's more, it becomes even more expensive if no suitable device for measuring the amount of flare gas is available. This is where all companies are in luck, as the FLOWSIC100 Flare is able to reliably measure the amount of flare gas, even under extreme conditions.

[Obligation to provide evidence and measurement accuracy](#)

Documentary evidence of the amounts of gas must be provided, regardless of whether the gas is burned at the flare

or processed. Measuring the mass flow, however, is complicated by fluctuating gas compositions and high flow velocities. In the event of emergency plant shutdowns or highly fluctuating delivery rates, velocities of over 100 m/s can be reached. Flow-generated noise and turbulence in the gas flow have a considerable impact on the measurement. Even short-term changes in the gas composition due to oil residue, water, sand, or sediment can significantly affect the measurement. Conventional gas flow measuring technology is therefore not suitable for this. The reliable measurement of gas quantities does however form the basis for precisely calculating the emissions levies in accordance with the "Emission of harmful substances (pollutants) generated by the burning of APG in flares" regulation. Measuring errors or the failure of the measurement at high gas velocities significantly increase the taxes that would be charged. The measurement inaccuracy must be smaller than 5 percent of the measured value for each plant site.

Which measuring device can already function perfectly under extreme conditions?

The measuring technology must be able to cope with a lot – Siberian winters with temperatures down to -60°C and heavily polluted gas. Ultrasound has proved itself to be the leading technology and SICK has made a name for itself with its flow measuring instruments in the natural gas industry thanks to the devices' exceptional ruggedness and accuracy, including for legal metrology. We are pleased to report that operators of oil fields are also extremely satisfied with the measurement performance of the FLOWSIC100 Flare. "They are able to rely on rapid and accurate measurement data, which is archived as perma-

FLOWSIC100 Flare mass flow measuring device



The FLOWSIC100 Flare works almost exclusively without contact or loss of pressure, which means it does not influence plant processes. SICK offers all device types in a replaceable design, which enables "hot tapping" installation. This means that the measuring technology can be installed or removed from maintenance purposes while the system is running, provided that safety precautions have been taken. Time-consuming and expensive interruptions to the process are therefore not required. In general, flare gas is measured by incorporating standard pressure and temperature sensors. Thanks to special algorithms, the FLOWSIC100 Flare can calculate the mass flow and even the molecular weight of the gas. This information provides added value to the customer, as it sheds light on the composition of the associated petroleum gas. A measuring tube with precisely aligned and pre-configured devices can be set up at the factory to provide even greater measurement accuracy and for plug & play installations. What's more, only SICK is able to offer ultrasonic flare gas measurements with a nominal pipe size of up to 72 inches.

nent data," SICK Russia promises its customers. With the FLOWSIC100 Flare, the unique sensor contour of the ultrasonic probe is adapted to the flow behavior, allowing any faults to be effectively reduced. The ultrasonic sensors, one of SICK's core competencies, have an above-average power and can also take reliable measurements from highly polluted gases. "This provides our customers with the assurance they require for their applications," confirms product manager Sven Holzbächer. State-of-the-art signal algorithms also enable very accurate measurements to be taken, even with respect to the "critical" flow of

particularly small quantities of gas. This ensures reliable and precise measurement across the entire flow in a flare gas plant – from range of 0.03 to 120 m/s. "The ability to quickly switch between the fluctuating flow velocities in particular is very important to us," confirms the operations manager of one of the largest oil fields in Siberia. "Other suppliers had difficulties here, including with the devices' self-monitoring function and diagnostic option. We take measurements with the 2-path layout. Then, if a measurement path fails due to contamination, the second path automatically takes on the role of the first. The device automatically detects when contamination on the sensors has increased and indicates when maintenance is required within good time. This enables us to plan maintenance work well in advance and means that the devices will not suddenly suffer a failure. It is for this reason in particular that we have found that ultrasound is the best technology when it comes to measuring associated petroleum gas." The gas can then be processed and transported to Europe, and recorded at defined measurement intervals for the authorities. (sh)



SICK IS COMMITTED TO ENVIRONMENTAL PROTECTION AND SUSTAINABILITY

THINKING ABOUT TOMORROW TODAY

SICK pays the utmost attention to ensuring that it minimizes its ecological footprint. Supplying customers with sustainable products and solutions that save resources is one aspect of this. The other is that SICK also wishes to minimize the impact that its own business activities have on the environment and to take on a leading role with respect to climate and environmental protection. This will then enable the company to live up to its mission statement and its core values of innovation, leadership, and independence.

>> Adhering closely to the tradition of the company founder, Dr. Erwin Sick – who showed a passionate concern for the environment even more than 60 years ago – SICK has therefore made a conscious decision to develop the company in a sustainable way. As a result, climate and environmental protection is an integral part of the strategic direction, business processes, and corporate culture. The company lives by the following principle: SICK wants to keep the negative environmental effects which result from products, systems, and services, as well as during production processes as low as possible. A three-point climate and environmental protection strategy has been derived from this principle:

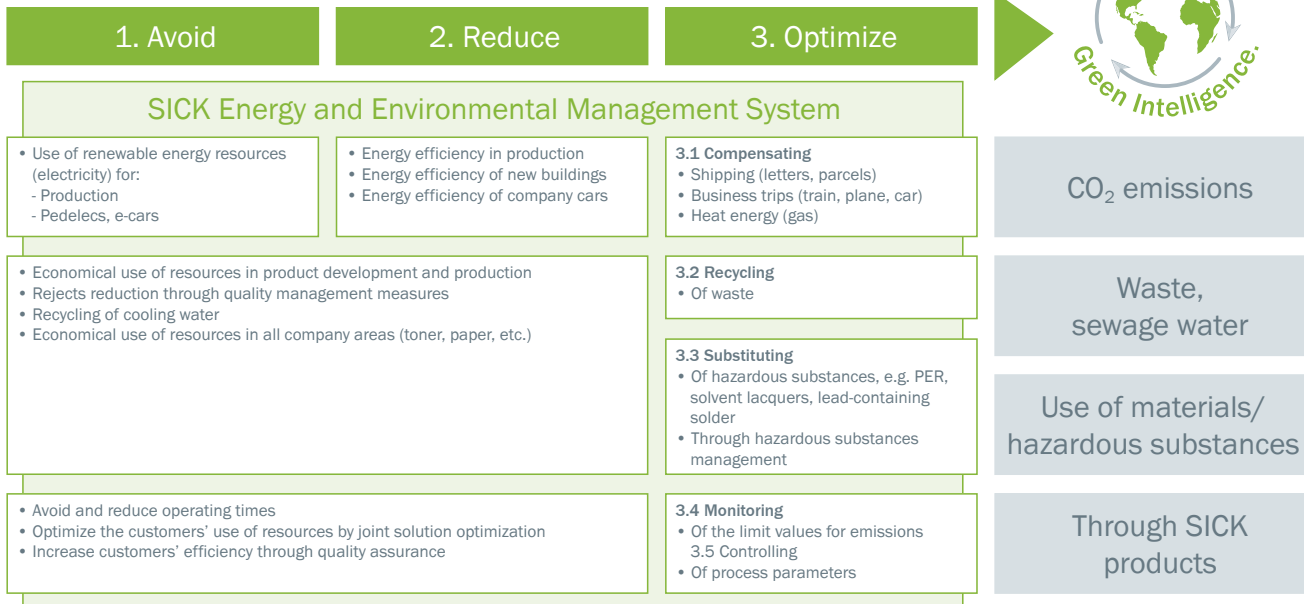
- 1 We avoid what we can.
- 2 We reduce what we cannot avoid.
- 3 We optimize what we cannot reduce.

The basis for this strategy is formed by an environment and energy management system that has been firmly established within the company for a number of years. All German sites and the producing subsidiaries in Hungary and the USA have been certified according to the environment management system ISO 14001 since 2006. In addition to this, the headquarters in Waldkirch, the site in Reute, and SICK Vertriebs-GmbH in Düsseldorf have an environment management system in accordance with EMAS (Eco-Management and Audit

Scheme) and a certified energy management system according to ISO 50001. SICK publishes an annual environmental statement in accordance with the EMAS standard, which uses core indicators to provide information about all relevant environmental impacts and the environmental objectives derived from them.

SICK achieves these environmental objectives by implementing projects in a wide range of divisions as part of the three points that are defined in the climate and environmental protection strategy.





A FEW EXAMPLES OF CLIMATE AND ENVIRONMENTAL PROTECTION PROJECTS AT SICK:

Electricity from renewable sources:

Since February 2013, all of the electricity supplied to each of the company's sites in Germany comes from renewable sources. What's more, several sites use photovoltaic systems to generate energy.

Increased energy efficiency:

SICK is a rapidly expanding company with a growing need for production and office space. Having an energy concept for each new building makes a considerable contribution to optimizing overall energy consumption. In addition, existing buildings and the entire infrastructure are renovated to improve their energy efficiency, for example by replacing the ventilation systems. A comprehensive measuring system is also installed, which helps unlock potential for savings.



Promotion of environmentally friendly mobility:

SICK is a global company and business trips between the individual sites, in particular to and from the headquarters and Waldkirch, are often unavoidable. Such trips are replaced by telephone or video conferences wherever possible. If business trips are necessary, these are made in the most environmentally

friendly manner possible. Four electric Smart cars, which are supplied with green power, have been in use since July 2011 to cover short distances between sites. Dorothea Sick-Thies, the youngest daughter of the company founder Erwin Sick, actively supports the issue of environmental protection at SICK and has financed these electric cars. Elec-

tric bikes are also available and can be used by employees. The "Environmentally friendly trip to SICK" work group has been working for many years to encourage employees to switch to environmentally friendly modes of transport, such as bikes or public transport. Another step towards reducing CO₂ emissions is the Green Car Policy, which has been in



place to then replace further standard colors.

SICK's climate and environmental protection activities are highly varied but they all follow a key principle: they deliberately focus on the areas in which they are able to have the greatest effect and are sustainable. They play a part in enabling SICK to make improvements every single day and to make an important contribution to creating a future that is more secure. (re)

effect since February 2013. It is based on a settlement model that provides a monetary incentive to select a low-emission vehicle.

Compensation for unavoidable CO₂ emissions:

In conjunction with the atmosfair organization, SICK is implementing its own ecological/social project in line with the highest environmental standard (CDM Gold). This has involved providing fuel-efficient wood stoves to Nigeria, which cut down on the amount of firewood used by 80 percent. Participating in this scheme allows SICK to offset its unavoidable CO₂ emissions, such as those resulting from air travel. A climate protection project relating to wind power or solar energy is planned for next year.

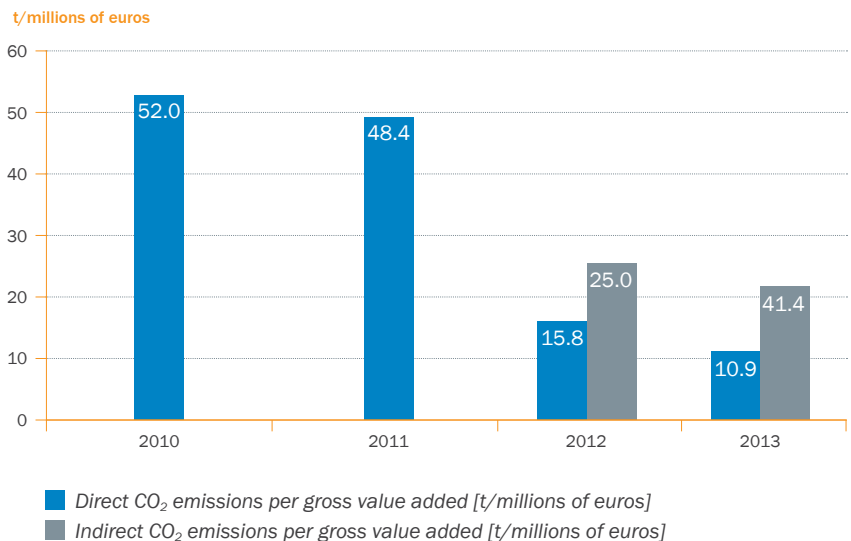
Environmental protection right from the product development phase:

SICK lays the foundations for the use of sustainable materials and production methods right from the product development process. This process follows a set procedure. A key part of this is the assessment of ecological aspects based on a checklist.

Replacement of hazardous substances:

Solvent-based coating systems are used in the paint shop. Strict limit values must

be complied with for these products and are monitored annually based on a solvent balance. In order to minimize the emission of solvents into the atmosphere, SICK has firmly established the intention to substitute solvent-based paints and primers with water-based coating systems in its climate and environmental protection strategy. Some solvent-based primers have already been replaced with a water-based primer. The blue water-based coating is currently in the final stage of testing. Plans are in





MORE THAN A VISION
THIS IS **SICK**

Sensor Intelligence.

In the real world, providing an effective solution for automatic identification requires more than just one technology. With SICK you have a choice. Three technologies, one philosophy: customer needs come first. For decades, customers have recognized SICK as a pioneer in vision, a leader in industrial code reading, an RFID specialist, and an expert in connectivity and big data. Our global technology experts are specialists in your industry and are located in your corner of the world. To meet your everyday challenges, it takes more than a vision. We find intelligence is what truly makes the difference.

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