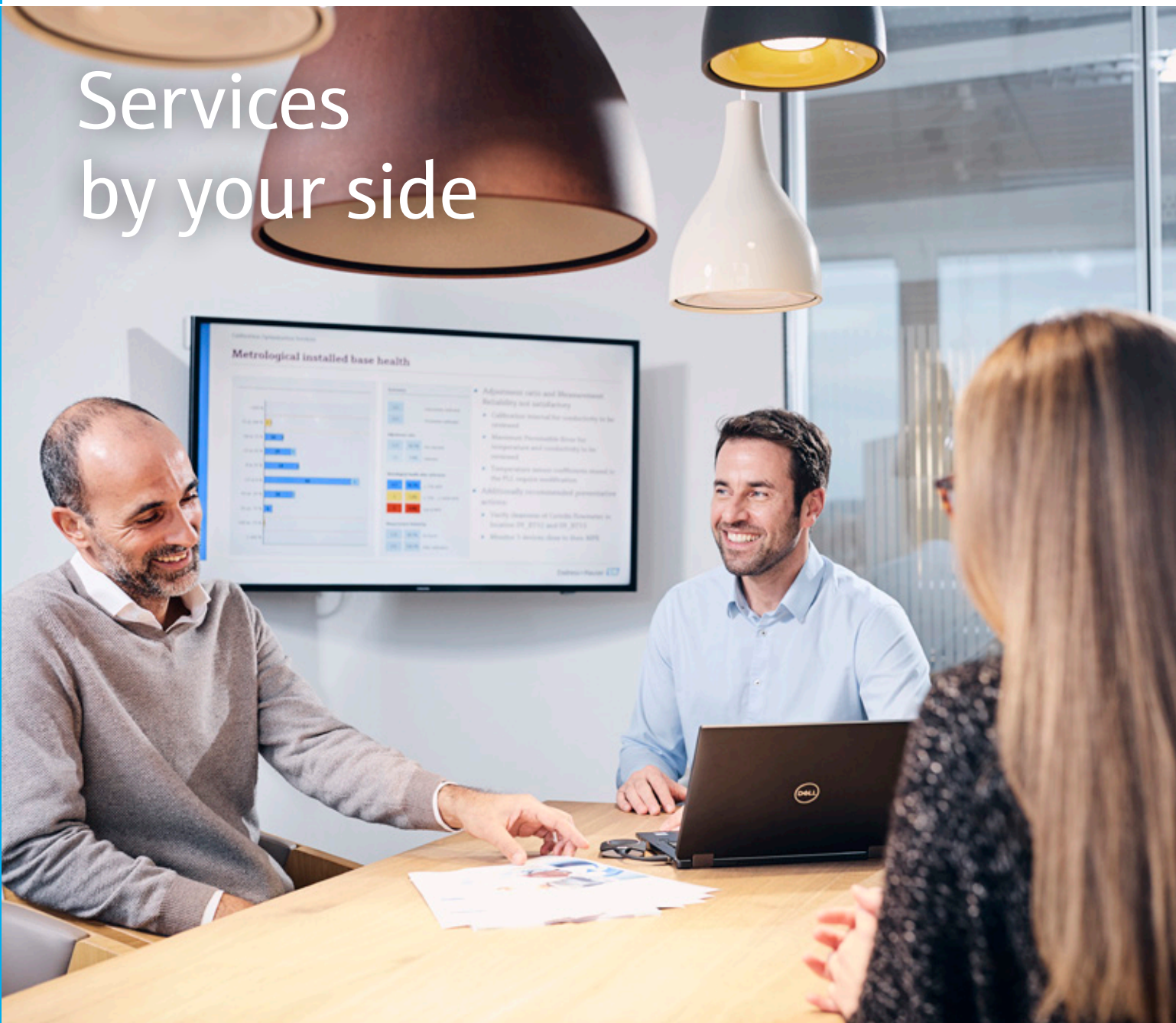


competences

Committed to improving plant performance for your success

Services
by your side





Your challenges, our mission

In an ideal world, there would be 100% efficiency, losses would be non-existent, there would be no material or operating errors in plants and processes would run smoothly until they are no longer needed. The reality, however, is different, as anyone who has ever seen plastic production, manufacturing of food products and beverages or a refinery from the inside knows. Even if the theoretical ideal state cannot be achieved by the laws of physics, engineers in the process industries are working hard every day to push the boundaries to gain higher yields and fewer losses.

But it is not only outputs that have to be optimized in order to succeed in global competition. To generate higher returns, on the one hand unplanned shutdowns have to be avoided, and on the other hand the installed base has to be used more effectively. In addition, there is a shortage of skilled workers and rising expectations in terms of health, safety and environmental protection. One thing is clear: the challenges for quality and maintenance managers are constantly rising.

In the context of increasingly complex processes and systems, it is becoming more difficult to manage these efforts completely internally. No wonder, given that fewer than 25% of experts in the oil and gas industry, surveyed for Deloitte and MIT Sloan Management Review, consider themselves well prepared for the use of digital solutions, IoT and analytics.

Only the combination of expertise, reliable technology and modern methods of digitalization helps to increase overall competitiveness permanently. As a partner to the process industries, Endress+Hauser has been committed to optimizing production processes with sensors, measuring and analysis equipment since its foundation in 1953. In our role as a service provider, dedicated teams with acknowledged service experts and years of comprehensive experience in various applications and industries help increase plant availability by providing, for example, maintenance and calibration services and remote support. Thus we help reduce operating costs and ensure compliance with standards and regulations.

We are committed to improving plant performance for your success.



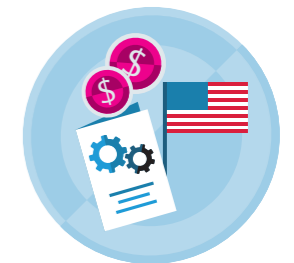
10% CAGR decrease in shareholder performance (TSR) of diversified chemical companies between December 2017 and June 2019 – the most pronounced deterioration in performance.

Source: "Chemicals and capital markets: Searching for a way back to the winner's podium", McKinsey&Company, November 2019



36% less unplanned downtime is experienced by operators using a predictive, data-based approach compared to those with a reactive approach. This can result in, on average, \$34 million dropping to the bottom line annually.

Source: "The Impact of Digital on Unplanned Downtime", Baker Hughes



\$2 trillion lost economic growth in US - companies must use capital to comply with regulations instead of investing in plant and equipment.

Source: National Association of Manufacturers press release, Accessed Jan. 9, 2020



\$8.5 trillion could be the value of unrealized annual revenue worldwide in 2030 as a result of a global shortage of more than 85 million skilled workers.

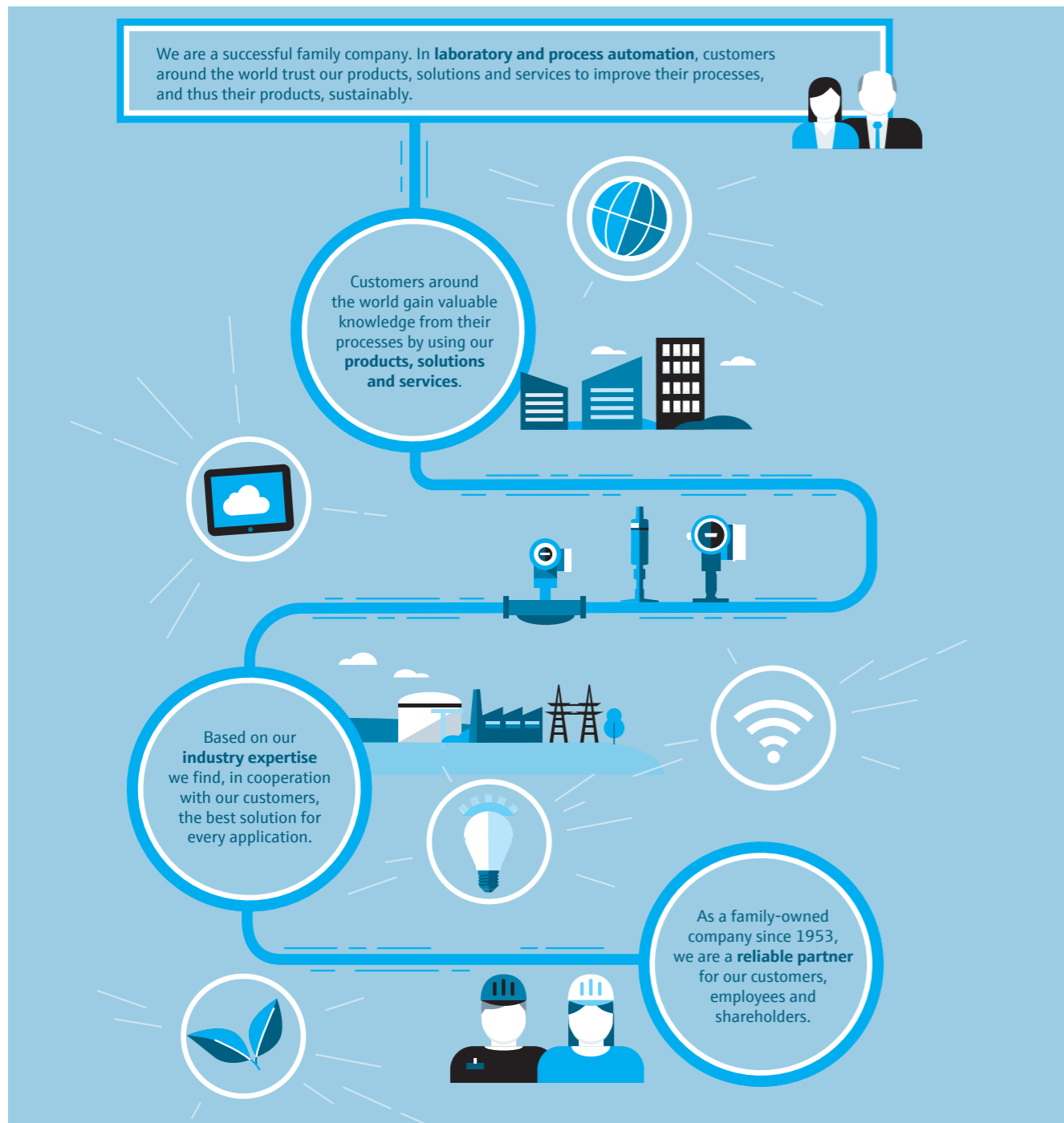
Source: Korn Ferry Consulting 'Global Talent Crunch report' 2018

Services by your side

Committed to improving plant performance for your success

By your side, with total commitment, today and into the future, Endress+Hauser will help you both meet and surpass your specific industry challenges. It is what drives us; it is what defines us. As the globalized, 24/7 economy in which you compete brings unprecedented margin pressure, we deliver the incremental OPEX reductions and plant availability gains to make the difference.

As new regulations to protect people and the environment demand rethinking of processes, we help you comply while remaining competitive. Moreover, we are here to ensure that relentless technological progress does not become a threat but an opportunity. With Endress+Hauser Services, you give yourself every chance of success.



Want to know more about our service expertise? Then visit us at www.endress.com/instrumentation-services



Reduce OPEX

Every organization that wants to stay competitive has to strive to increase its profit. When it comes to process industries, reducing operational costs is crucial and always in focus.

p. 8



Increase plant availability

Digitization is a core aspect in the effort to achieve efficient and resource-saving operation. With the right partner you can keep your process reliable and running at maximum capacity.

p. 10



Remain compliant

In a globalized world, the number and complexity of rules, regulations and laws increases. The right partner can help optimize important operational management tasks while working in compliance with the rules.

p. 14



Access technical expertise

It is increasingly challenging to recruit and retain talented employees with technical know-how around process measurements. With new digital channels, it is possible to access knowledge and expertise remotely.

p. 16

How we contribute to your success

From commissioning of your devices, technical support, diagnosis and troubleshooting, preventive maintenance, calibration and training to optimization consultancy, Endress+Hauser is there for you throughout the entire plant life cycle.



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Reduce OPEX

Every organization that wants to stay competitive has to strive to increase its profit. When it comes to process industries, reducing operational costs is crucial and always in focus.

Maintenance and calibration optimization

How can you find the right balance between costs and maintenance activities without compromising safety. A review and redesign of the maintenance processes in a plant can enable maintenance and plant managers to make decisions on how to reach strategic asset management goals. On one hand Endress+Hauser consultants use in-depth metrological expertise and analyze calibration data to help customers find their optimal calibration intervals. On the other hand our asset management specialists review current maintenance processes to provide recommendations to reduce operational costs.



\$1 million cost per downtime event, which lasts about four hours on average across all investigated industries.



Tailored service agreements

Maintenance and calibration of your instruments need to be performed on a regular basis to ensure consistent performance and safe operation. Endress+Hauser provides customizable service agreements that help improve your asset availability and maintain your processes' reliability. We offer guidance, schedule work orders, take care of your routine maintenance tasks and enable easier budget planning. We are dedicated to:

- meeting your performance and compliance deadlines according to your quality standards
- providing accessible documentation
- increasing efficiency built on our instrument and application know-how
- proposing improvements benefiting from our competence in metrology.

Thorough management of your maintenance processes

With Managed Services, Endress+Hauser takes over the day-to-day management of the field instrumentation responsibilities as a strategic method for improving operations and accelerating return on instrument investments. We define effective processes to schedule, track and record the maintenance of your critical instruments, and commit to achieving agreed performance goals. Key performance indicators help measure progress and as they are regularly reported - demonstrate the realized efficiency gains. When you choose Endress+Hauser as your single point of contact on the plant, we also ensure work orders are completed for third-party partners to make sure that all the required service activities are completed on time. We bring peace of mind and enable optimized productivity of your business processes with increased plant availability, transparent cost control, high quality standards and efficient asset management.

Remote support

Downtime or process interruptions cannot be afforded when an application is critical. That's where Endress+Hauser provides the best technical support network to keep operating systems, instrumentation or solutions running. Many faults with process instrumentation can be diagnosed and resolved remotely. We can quickly determine whether issues can be solved over the phone, via live video or remote access to your instrument. Remote support reduces on-site visits, thus providing cost and time savings. Customers benefit from easy access to our technical expertise to answer nearly all service needs efficiently.



Maintenance Process Analysis

Effective maintenance processes

Well-designed and lean instrument maintenance processes with a clear implementation plan decrease expenditure, improve plant performance and reduce risks. Maintenance Process Analysis is a consultancy service. Existing processes are reviewed and optimized instrumentation maintenance processes are (re)designed. This covers some of the following maintenance-related processes:

- Preventative maintenance (calibration/inspection/verification execution)
- Corrective maintenance (breakdown/repair)
- Condition-based maintenance/predictive maintenance
- Obsolescence and stock management.

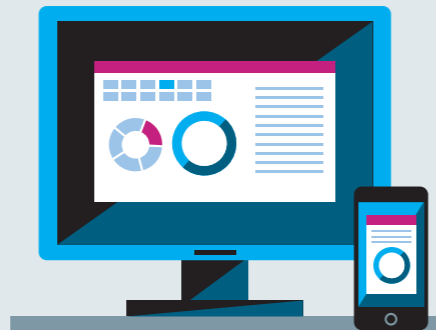
A Maintenance Process Analysis includes a recommended tooling landscape, suggestions for actions, a potential savings calculation and an implementation plan. This enables customers to make informed decisions on how to optimize the maintenance program for their instruments with significant savings in maintenance OPEX.

Increase plant availability

Digitization is a core aspect in the effort to achieve efficient and resource-saving operations. With the right partner you can keep your plant compliant and running at maximum capacity.

Get full transparency over the entire life cycle of your plant

If you can't measure it, you can't improve it. This often-quoted maxim demonstrates how to avoid ineffective maintenance programs, unknown risks and long or unexpected process downtimes. In addition, applying up-to-date instrumentation technologies will reduce complexity and provides full transparency to avoid risk and ensure best plant performance. Endress+Hauser's Installed Base Analysis collects and analyzes data to ensure accurate asset management with recommendations to improve your maintenance strategy. Our services make your processes future-proof, including maintenance and obsolescence management, while lowering risks. Asset performance stays on target. Plant availability is optimized.



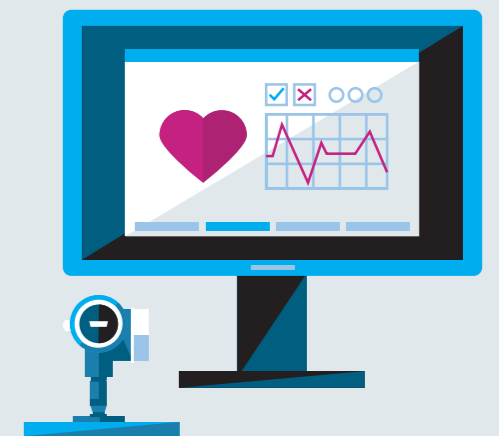
i IloT - Digitalization
Harness the power of connected data and move towards your digital future. To achieve the outcomes you care about, the huge amount of data from your field devices needs to be analyzed and translated into actionable knowledge. For this we developed our **Netilion IloT ecosystem** and portfolio of web and smartphone apps. Netilion unlocks the full potential of your instruments to give you the insight you need to vastly improve maintenance efficiency, enable the deployment of preventive and predictive maintenance strategies, and optimize your processes over the entire life cycle.



1-5% of total business expenditure is estimated to be saved as a result of improving the efficiency of asset information management within your business.

Improve diagnostics and maintenance workflows with remote expertise

Modern process plants use high-end instrumentation to ensure the best possible quality and reliability of their production and to achieve their business outcomes. But a higher level of measurement complexity requires more knowledge and expertise for plant personnel to perform necessary service operations, especially for diagnostics and troubleshooting. Nowadays, many issues can be solved remotely, avoiding field service call-outs and ultimately decreasing the total cost of ownership of your instrument. Endress+Hauser has the right technical knowledge of a broad variety of measurement devices and the processes they are used in. With Connected Support, you not only save the cost of field service visits but also ensure you stay compliant through proactive monitoring of your process-critical applications. Additionally, you take the pressure off your own maintenance staff with access to our extensive technical knowledge base.



i Heartbeat Technology
Thanks to Heartbeat Technology, measurement points can be easily verified without interrupting your processes. As the devices continuously diagnose themselves, test cycles can be extended. And the self-diagnostic functions of our instruments not only increase the reliability and safety of critical measurement points but also support your documentation with automatically generated reports. These reports also provide precise instructions for necessary maintenance procedures. Furthermore, the process and device parameters can be used to optimize your maintenance efforts and your processes.



Predictive maintenance

The evolution of maintenance in process industries has reached a status where each individual device can be checked and its health monitored 24/7. Nevertheless, most maintenance activities are still of a preventive nature. But maintenance guided only by fixed intervals, regardless of the condition of the asset, leads directly to decreased performance and can be the cause of an unplanned shutdown. The right predictive maintenance strategy will give early warnings before a performance decrease happens and enough time to plan corrective actions at an early stage to reach the maximum availability of the plant. How to get there? Combining instrument data, algorithms and the application know-how of Endress+Hauser builds the foundations to successfully implement predictive methods.

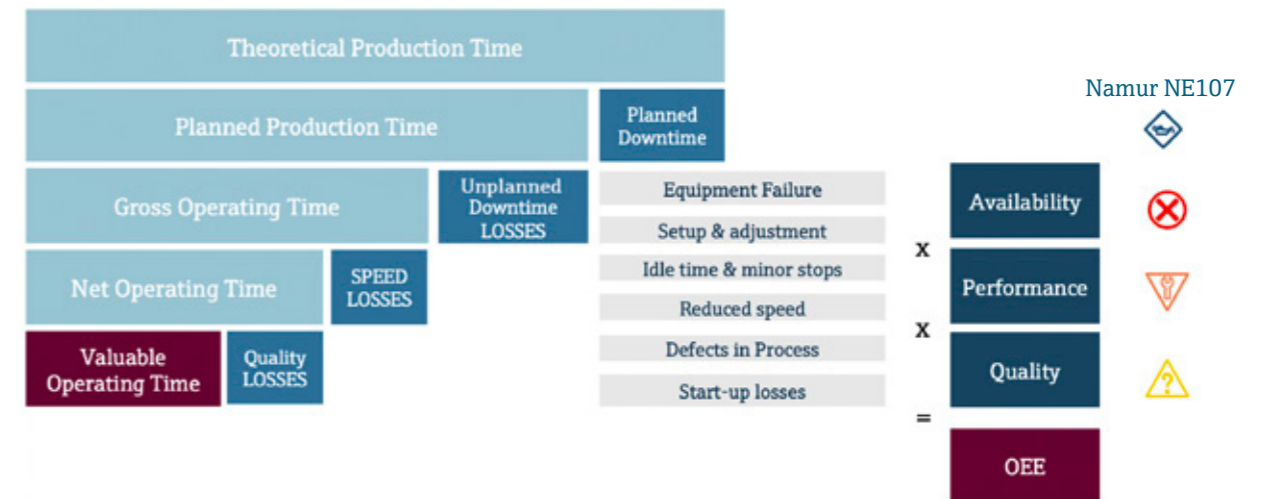
Only 24% of operators in oil & gas describe their maintenance approach as a predictive one based on data and analytics.

How to boost overall equipment effectiveness

More and more stakeholders expect that process plants are operated according to dedicated KPIs. The most common indicator is Overall Equipment Effectiveness (OEE), calculated from the sum of quality, performance and availability. As a result, it expresses plant performance and gives a good insight into planned production time versus valuable operation time. The health status of devices (according to NAMUR NE107) has a direct link to the three parameters of OEE.



Overall Equipment Effectiveness as a major Key Performance Indicator in manufacturing



Verification of measuring instruments

Gain measurement confidence while meeting compliance requirements
 We bring proven instrumentation and maintenance know-how to deliver a comprehensive functional assessment of instrument reliability that enables you to meet all necessary compliance requirements, reduce unplanned downtime and optimize maintenance costs.

- Minimize process interruption with in-line verification
- Reduce risk with reliable instrumentation performing according to functional and safety specifications
- Fulfill regulatory, quality and safety requirements with documented verification traceable to international standards
- Combine verification with calibration for enhanced device reliability and metrological performance

Connected Support

Keep your devices up and running
 The Endress+Hauser Liquiline System Analyzers measure, for example, ammonium or ortho-phosphate for precise dosing of precipitant in wastewater treatment. To keep these high-end measurement devices up and running over time, Endress+Hauser offers Connected Support through remote monitoring of the analyzer health conditions. To avoid unexpected process interruptions, operators receive proactive notifications any time maintenance or troubleshooting becomes necessary. With access to remote expert guidance, the operation of the analyzer is much easier and faster, enabling significant savings in maintenance OPEX.

Remain compliant

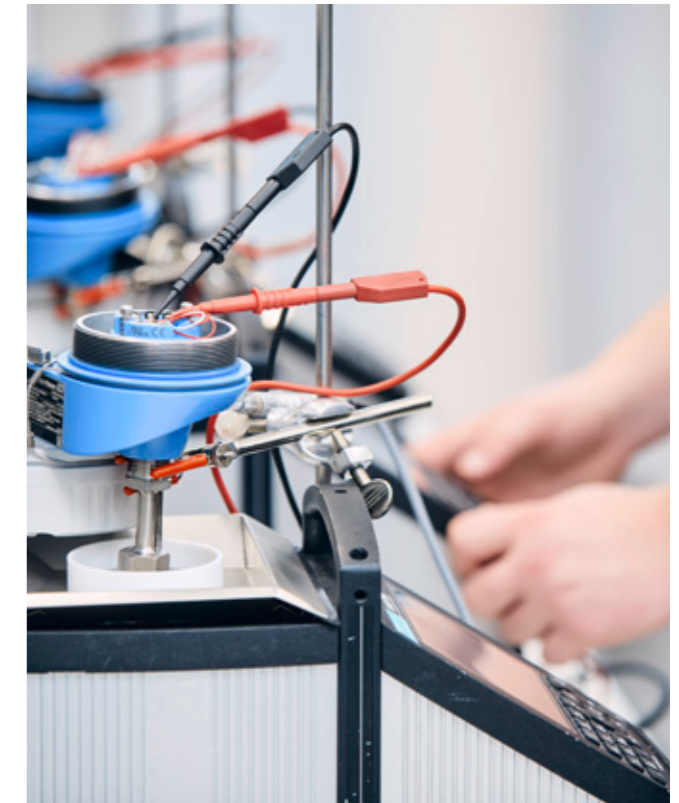
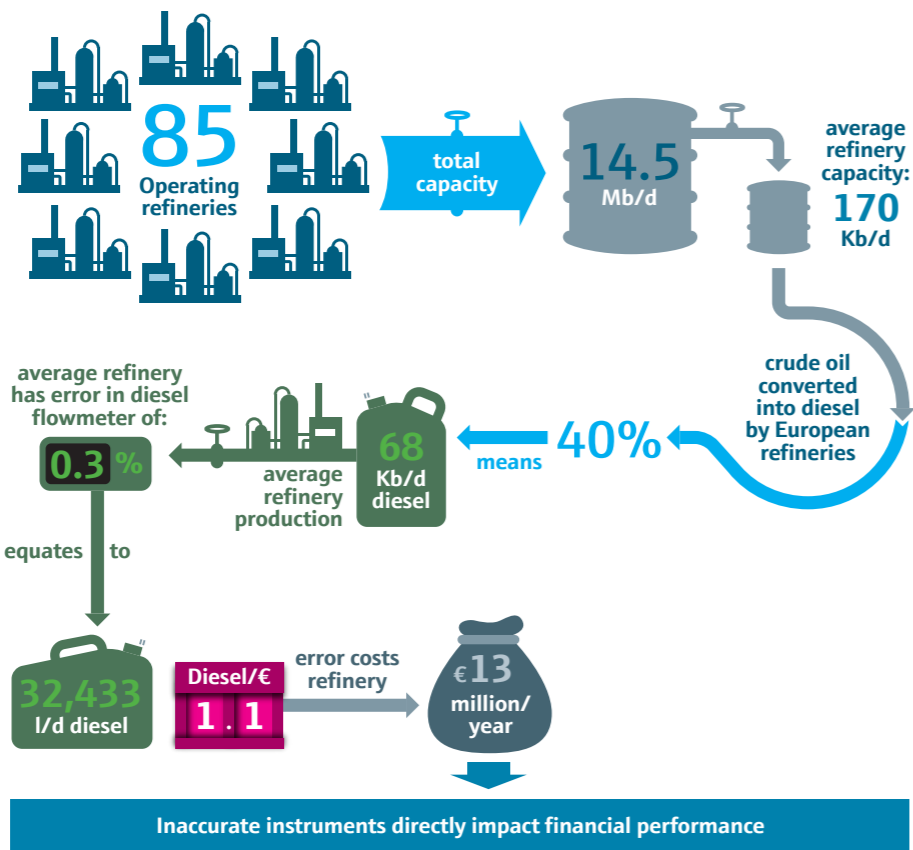
In a globalized world, the complexity of rules, regulations and laws increases. The right partner can help optimize important operational management tasks while working in compliance with the rules.

Global standards implemented locally

Instrument calibration is a standard element of ISO 9001 quality systems for industrial manufacturing plants. Poor calibrations lead to inaccurate meters, which have consequences for product quality, energy efficiency, yield and financial losses. To ensure the required quality level in calibration, Endress+Hauser has developed and centrally manages its own standards such as training and certification programs for our calibration operators, standard operating procedures, mobile flow rig designs and proficiency testing loops. The result is a high level of confidence in calibrations supplied by Endress+Hauser service centers located all around the world.

A source of reliability and compliance

A modern plant manager has to be competent in a broad variety of aspects. The processes must be reliable and cost-efficient. Breakdowns have to be a rare occurrence; shutdowns should be planned and scheduled. In addition, especially in highly regulated industries like life sciences and food & beverage, it is an ongoing task to keep plant and actions compliant to Good Manufacturing Practice (GMP). Endress+Hauser's verification and calibration services ensure measurement compliance to industry standards. These services give confidence to internal and external stakeholders that the instruments are performing correctly and within the defined tolerances. Day-to-day operational management of the calibration function is eased. Potential for improvements and propositions for corrective actions are continuously delivered, ensuring that calibration performance KPIs are reached.



Stay safe – stay compliant

Safety is a top issue in all process industries. Some aspects such as flammable or explosive gases or dusts are a challenge especially in the chemical and oil & gas sectors. Life sciences and food industries, on the other hand, have a major focus on product safety. Here, you have to safely exclude the risk of contamination by microorganisms or other contaminants. In all these industries Endress+Hauser is a reliable partner that offers a broad variety of instrumentation quality aspects like Good Manufacturing Practice (GMP) and services like calibration and verification or SIL device commissioning to set up the instruments according to Standard Operating Procedures. This ensures the functionality and performance of the instruments in accordance with the conditions of use and your specifications to stay compliant and safe.

Calibration Management Service

Reduce non-conformities and ensure important information is traceable

With calibration management, Endress+Hauser aims to achieve calibration excellence with metrology and maintenance expertise. Calibrating at the right time and in the right tolerance ensures the quality of your products in compliance with relevant standards and regulations. Transparent data and accessible documentation allow effective process scheduling and tracking and recording of the calibration for your critical instruments. We take responsibility for the day-to-day management of the calibration function, measure and regularly report the calibration performance metrics and continuously identify and implement improvement possibilities.

Calibration Interval Optimization

Balance measurement reliability with operational expenditure

Covering Endress+Hauser and all third-party instruments, our metrology experts will partner with you to constantly optimize your calibration intervals, reducing both your risks and overall costs.

- Review your criticality and maximum permissible error to ensure the new calibration intervals have a solid base.
- Receive calibration interval recommendations based on proven data-modeling techniques.
- Rely on expert support to interpret results and take the best decisions.
- Switch to optimized calibration schedules and fit all operational and process constraints.

Access technical expertise

It is becoming increasingly challenging to recruit and retain talented employees with technical know-how around process measurements. With new digital channels, it is possible to access knowledge and expertise remotely.



Application and industry know-how

Because instrumentation is vital for your process, we bring in decades of experience in a wide variety of applications in your industry. Our network of experts is perfectly positioned to provide your business with the right expertise. Endress+Hauser supports customers throughout the entire plant life cycle to find the best solution based on our knowledge thanks to our strong application and industry expertise. Our global application support team ensures that all customers select the best-fit devices for their industrial applications. Additionally, our technical support organization provides knowledge and advice for every step of using our devices. The service consultants have the ability to improve overall asset performance. We understand your business!



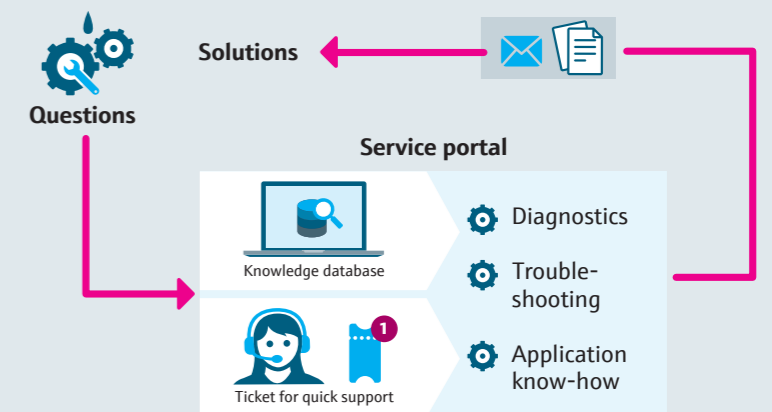
i Innovative measuring technologies
Endress+Hauser takes pride in being one of the most innovative companies in the process automation industry. We have a portfolio of more than 8,000 patents and patent applications. This figure is no coincidence, given that we reinvest more than 7 percent of our revenue into research and development. The current focus of Endress+Hauser's service innovation is digitalization and its meaning for customers. As a result, our offering has been enhanced with, for example, technology to "go digitally on-site" and technologies to use data from devices in combination with data from service activities to optimize maintenance. Service innovation is with customers - i.e. keeping customers in the loop or co-creating with customers - so that we can ensure any new elements perfectly fit the needs of our valuable customers.



i Get one-on-one technical assistance from the specialists

Benefit from Endress+Hauser's growing database of knowledge and extensive service expertise from real support cases. The service portal provides immediate and swift access to articles on diagnostics and troubleshooting, product and application know-how such as service operations. Simply log in, describe your issue and access the knowledge database for an immediate solution. If your case is missing, enter a new one that will be handled by your support expert. Fast and easy, online at any time.

- Growing knowledge database
- Quick support on ticket basis
- Fast access to support case history



Qualified capabilities and competencies

In order to offer our customers the highest-quality products and services, quality management has to be part of the culture - just like at Endress+Hauser. Continuous learning and development of people lead to high employee satisfaction and ultimately assure an excellent quality of service delivery. To ensure that organizational capabilities and competencies are kept at a high level, service processes are reinforced via training and regularly assessed. They are also linked to internal, national and international standards.

i Instrumentation Support

Speed up your maintenance

Instrumentation Support provides the necessary help from Endress+Hauser experts who address technical inquiries on instruments and processes in a timely manner. In the event of an incident or unexpected downtime, our experts are available to get you back up and running quickly. They are able to perform remote diagnostics, troubleshoot your instrumentation and guide you through service operations. Support is available through live video transmission and screen sharing. We offer different service level agreements with guaranteed response times to best fit your needs and to help you rapidly overcome incidents.

References



Optimized diagnostics and maintenance with cloud-based support platform

Customer challenge

Many wastewater treatment plants are located in rural areas far apart from each other and are operated without staff. This is all the more challenging if a malfunction occurs at an analyzer, and plant operation is affected. The EmscherGenossenschaft/Lippeverband (EGLV) wastewater management company in Germany wanted to avoid unscheduled service operations with wasted time and unnecessary cost. However, diagnosing and remedying faults at the analyzer is very complex and, in some cases, can only be done with the help of experts.

Our solution

Endress+Hauser developed a measuring station for sample filtration in collaboration with EGLV. The station comprises an orthophosphate analyzer and sample preparation system and was installed in a biological aeration basin. An edge device connected it to the Netilion IIoT platform over the mobile network. In this cloud environment, the continuously sent encrypted measurement data and status information were available 24/7.

Customer benefits

- Reduction in personnel requirements on-site
- Fast technical advice using live video
- Increased availability of measuring devices



Flexible calibration optimizes downtime and reduces production losses

Customer challenge


Al Safi Danone produces milk and dairy products in Al Kharj in Saudi Arabia. One important goal for automation engineers is the timely and accurate calibration of its production equipment to minimize waste and enhance the quality of output. The challenge is to perform the work in a timely manner and to keep maximum production availability to meet sudden fluctuations in demand. The only option is to use the rare opportunities when production is delayed for cleaning to make the necessary interventions, regardless of the time or day of the week.

Our solution

A fully dedicated Endress+Hauser calibration team, consisting of one calibration engineer and one assistant technician, offers quick support in close coordination with Al Safi Danone maintenance and instrumentation teams. Additionally, a mobile flow calibration van with calibration rig is permanently stationed on-site for rapid equipment mobilization.

Customer benefits

- Total flexibility in service execution
- Timelines are met efficiently and ahead of time
- Calibration program always on track and instruments working accurately

 ... and how can we help improve your processes?

Visit us at www.endress.com/instrumentation-services



Calibration analysis in life sciences industry for actionable outcomes

Customer challenge

A well-known enterprise in the pharmaceutical and life sciences sector was looking to improve its measurement accuracy at one of its sites in India. Analysis of calibration data has been identified as key to achieving this improvement. The common routine calibration has not been providing data analysis at this stage. Calibration of all measuring devices needs to be on point and happen regularly but can only happen while the plant is shut down. Some devices need to be calibrated once a year, others every six months.

Our solution

The team implemented a separate service on top of the calibration: a Measurement Performance Analysis. This service provides transparency and insights into the calibration results to identify issues and the potential for improvement. All the metrological health data is translated into concrete recommendations and corrective actions to improve the calibration program.

Customer benefits

- Optimized risk, cost and reliability in production facility based on in-depth consultancy
- Compliance with quality and safety requirements
- Proof that calibration requirements have been met



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