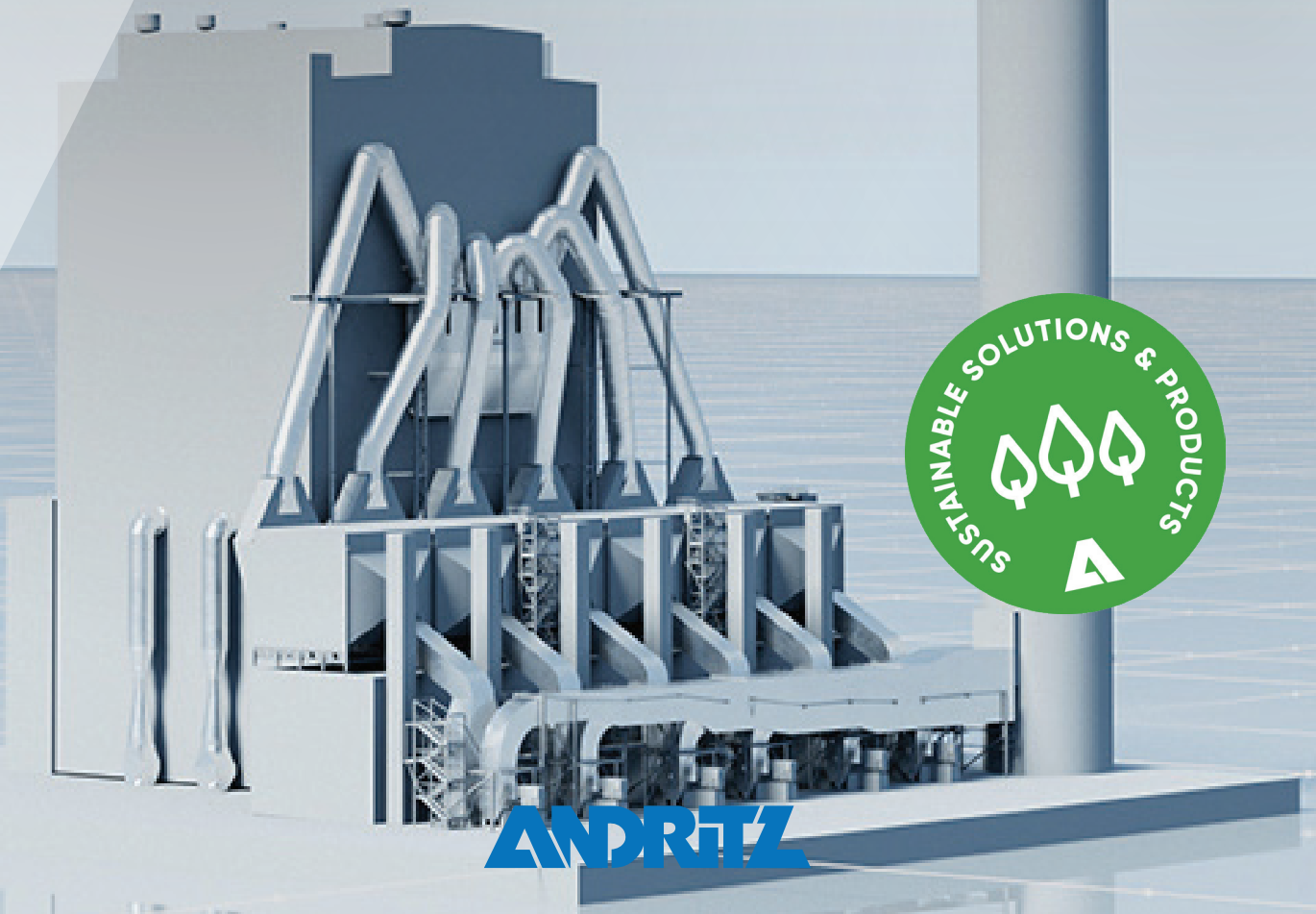PULP & PAPER

MAXIMIZE THE POTENTIAL OF YOUR RECOVERY BOILER WITH DIGITALIZATION

AUTONOMOUS RECOVERY BOILER SOLUTIONS

SUSTAINABLE SOLUTIONS & PRODUCTS

ANDRITZ

ENGINEERED SUCCESS

AUTONOMOUS RECOVERY BOILER

Combining our process expertise and state-of-the-art digitalization technologies, ANDRITZ has developed autonomous recovery boiler solutions, an all-in-one Industry 4.0 solution to help your recovery boiler achieve extra added value. In addition, an increasing level of autonomy can be obtained gradually through step-by-step integration of the autonomous recovery boiler solutions.

OVERALL BENEFITS

INCREASE STABILITY

INCREASE AVAILABILITY

INCREASE PRODUCTIVITY
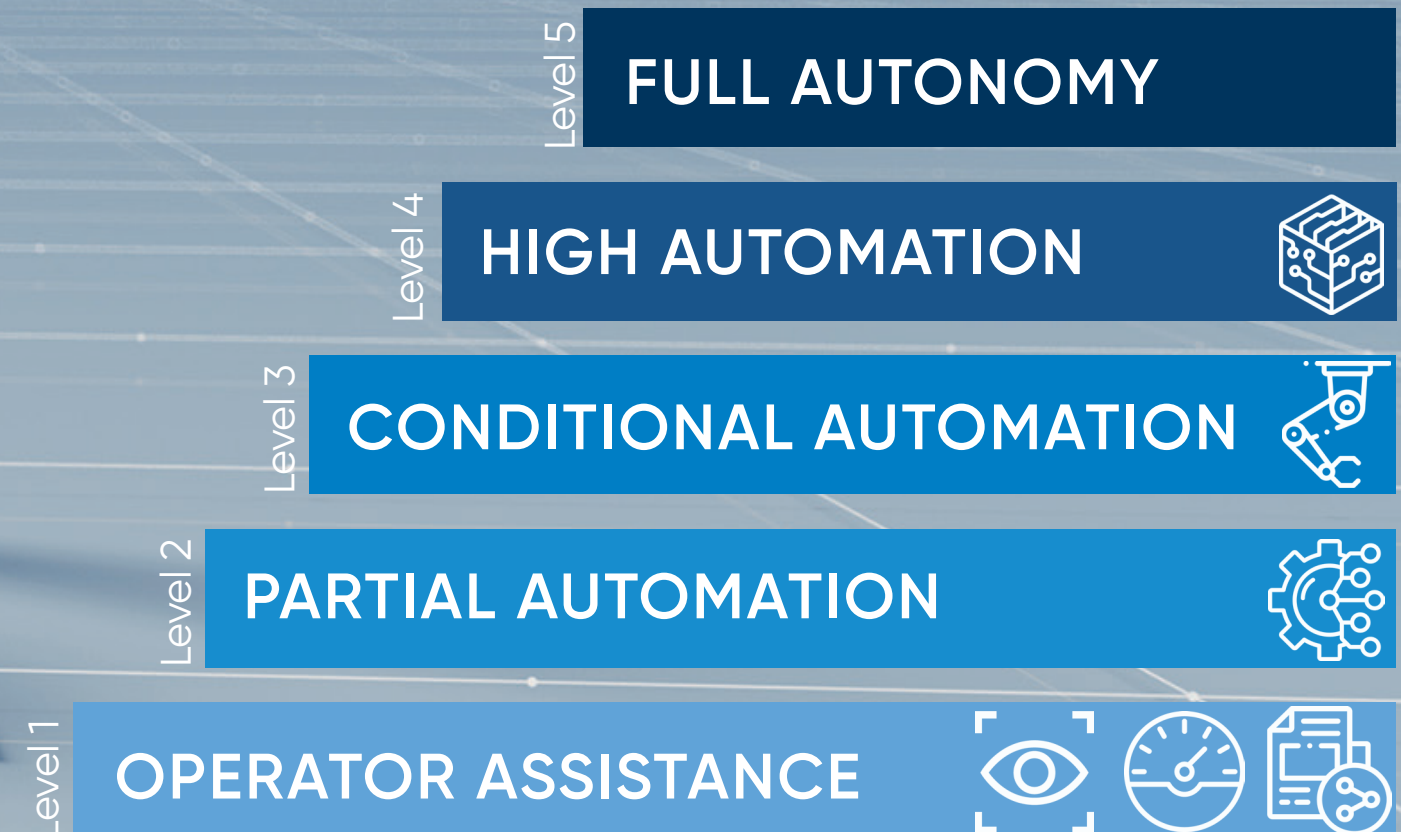
ADDITIONAL DATA

INCREASE SAFETY

IMPROVE RECOVERY

REDUCE OPEX

REDUCE EMISSION

FOUR STEPS TO FULL AUTONOMY

Level 5 — FULL AUTONOMY

Level 4 — HIGH AUTOMATION

Level 3 — CONDITIONAL AUTOMATION

Level 2 — PARTIAL AUTOMATION

Level 1 — OPERATOR ASSISTANCE

Metris AVA Recovery Boiler Toolbox

Metris AVA, Advanced Visual Analysis, is a measurement system by ANDRITZ that provides operators visual view as usable numbers. The solution combines modern image algorithms, cameras and machine learning with ANDRITZ process and device knowledge.

Metris AVA: RB Toolbox

OVERVIEW

In order to keep the mill performance at a certain level, mills need to analyze different samples of the process. AVA is a new, fast, reliable and cybersecured measurement system for all processes and environments, which provides operators a visual view as usable numbers. Metris AVA consists of compatible toolboxes that give opportunities to collect the data in order to improve mill performance. Recovery Boiler (RB) Toolbox is designed for the recovery boiler environment. The solution enables balanced recovery boiler performance due to exact online data for process optimization with decreased maintenance needs. In addition, utilizing the toolbox and analyzing the data ensure less fouling and washing and increases the process uptime, which again increases the mill efficiency. When the process is optimized, the mill can benefit, for example by increased chemical savings, and decreased emissions and laboratory tests.
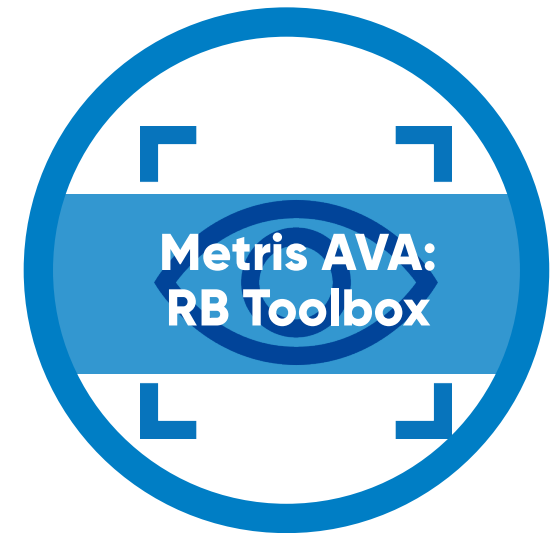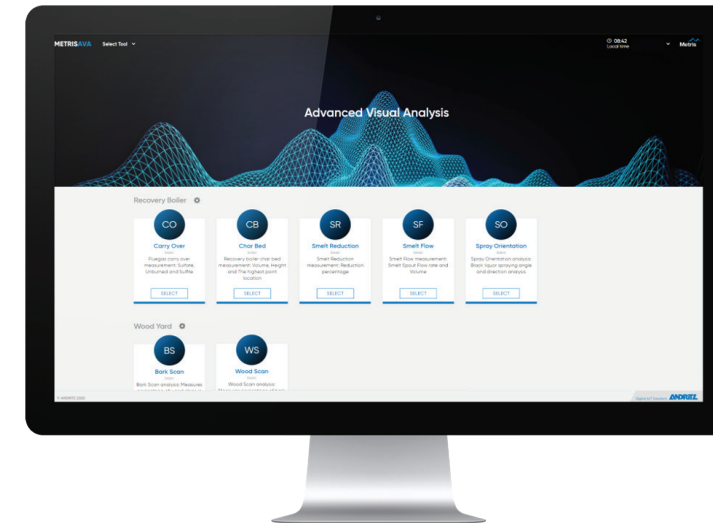
Metris AVA RB Toolbox consists of five tools, and by using the tools, personnel and process safety can be increased, and boiler performance can be balanced in order to achieve savings.

1 CARRY OVER TOOL

is designed to measure flue gas particles and it provides data to control liquor temperature and flow, sootblowing and air distribution. Analyzing the carry over data for example, increases availability and decreases emissions.

2 SPRAY ORIENTATION TOOL

measures the liquor spray direction and opening angle from the liquor burner. It provides data to control carry over, char bed location and spray burner maintenance. Analyzing the data can improve chemical recovery, ensure longer spray burner lifetime and balance char bed.

3 SMELT FLOW TOOL

measures smelt volume and velocity, and gives numerical information for spout fouling and flashing. By analyzing the data from fuel supply, air distribution, spout cleaning and green liquor quality, safety and savings can be achieved.

4 CHAR BED TOOL

creates 3D models from char bed and measures volume and highest points in order to provide data to control fuel supply and air distribution. By analyzing the data, the mill can improve safety and chemical recovery, balance combustion and reduce carry over.

5 SMELT REDUCTION TOOL

is designed for reduction efficiency measurement and it provides data to control fuel supply, char bed, air distribution and green liquor quality. Regular measurement of the smelt reduction can improve chemical recovery and reduce carry over.

Benefits

MORE SAFETY
- Safe measurement tools
- Increased overall safety by process stability

MORE PRODUCTIVITY
- Increased efficiency
- Balanced boiler processes
- Variability

MORE SAVINGS AND CAPACITY
- Increased chemical recovery
- Decreased shootblowing steam
- Decreased laboratory analyses
- Less emissions
- Balanced boiler processes

Metris HEWI Weight Indication System

Metris HEWI weight indication system is a sensor solution for estimating heat surface fouling via weight change measurement. HEWI can be installed to any hanging heat transfer surface and when connected to advanced process controls, it enables on-demand sootblowing with SMART Sootblowing.
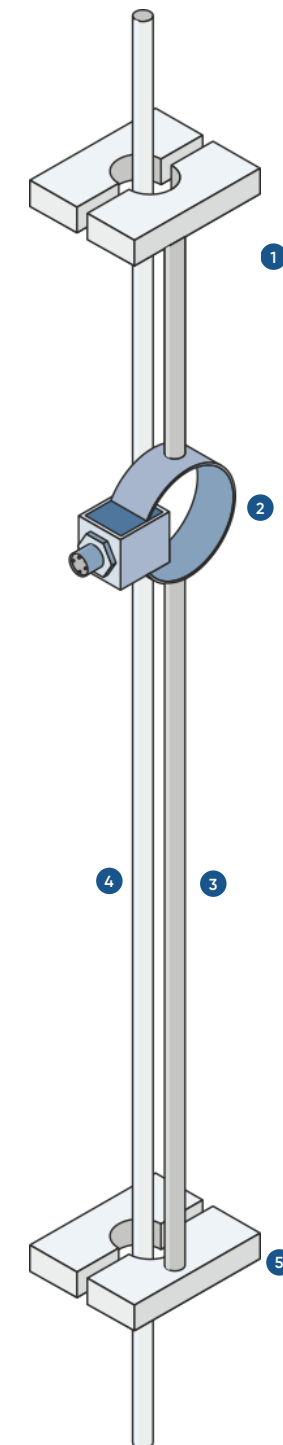
OVERVIEW

Fouling of recovery boiler heat transfer surfaces (eg. superheaters) are inevitable during liquor burning, and thick deposits will reduce steam production and availability of the boiler. Traditional method for keeping the heat transfer surfaces clean is to use continuous sootblowing for deposit removal, which is needed in order to keep the recovery boiler in operation.

The traditional sootblowing is controlled by pre-set recipe run intervals. Process data and measurement can be used for rough fouling estimate. ANDRITZ provides HEWI Weight Indication system with absolute

values to monitor fouling. The HEWI is an accurate measurement system to indicate accumulating fouling on heat transfer surfaces.

HEWI is a strain gauge based highly accurate measurement for weight changes in hanging heat transfer surfaces. The solution monitors measurement value changes to detect fouling, and a real-time ash weight indication can be used to significantly improve sootblowing. HEWI data, which is valuable information for targeted sootblowing and fouling detection, is saved in Metris.

Metris HEWI

ANDRITZ Patented solution

Strain gauge based measurement system

Monitors measurement value changes to detect fouling

HEWI data is saved in Metris

Can be further utilized when combined with Sootblowing ACE

1 INSTALLATION SPACE
Needed installation space is about one and half meters of accessible hanger rod.

2 SENSORS
Tailored sensors for each recovery boiler.

3 SENSOR ROD
Customized for each mill to optimize measurements.

4 HANGER ROD
Superheater supporting rods. Not included in HEWI delivery.

5 CLAMPS
Sensor rod clamps are installed to hanger rods.

Benefits

HEWI WEIGHT INDICATOR

- Real time fouling information for sootblowing optimization
- Improved cleanability and availability
- Reduced steam consumption
- Condensate identification during start-up
- Decreased wearing of superheaters due to optimized sootblowing
- No welding or shutdown is needed during the installation
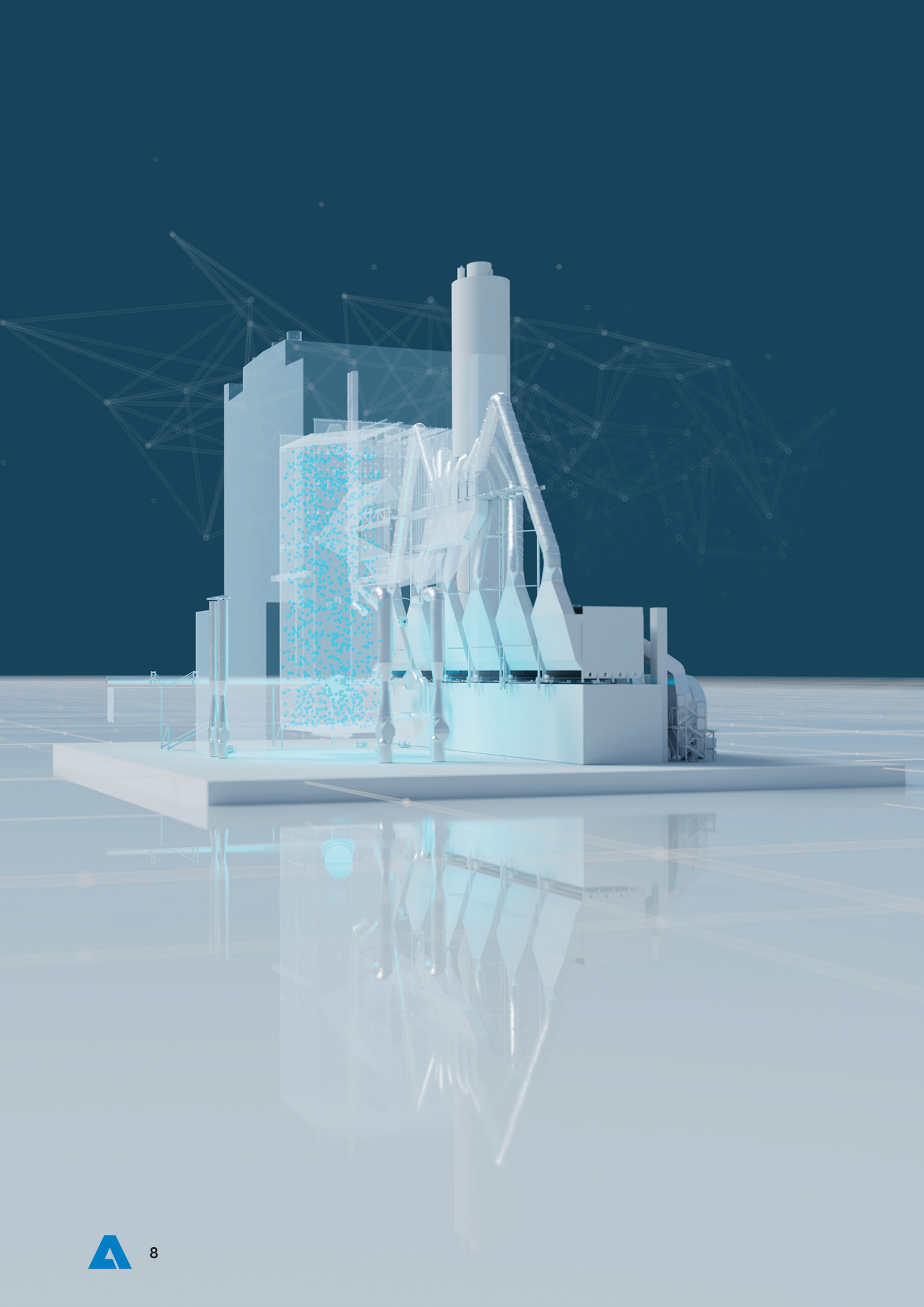
Metris WLA Water Leakage Advisor

Metris WLA

Artificial intelligence-powered leakage detection for safe recovery boiler operation. Metris WLA combines tradional mass balance calculations with machine learning algorithms predicting boiler conditions and detecting any abnormal process conditions associated with water or steam leaks. The analysis is based on normal recovery boiler instruments, but additional instrumentation can be used to improve leakage detection.

OVERVIEW

Water leaks inside a recovery boiler can lead to a dangerous smelt-water explosion, causing damage to equipment and injuring operators. Equipment damage also results in unscheduled downtime.

Traditional leak detection methods are often based on chemical or mass balance monitoring or tracers inside the boiler's water circulation system. These can be inaccurate or commit resources and require extensive know-how.

WLA WATER LEAKAGE ADVISOR

Undetected leaks in the recovery boiler may result in expensive consequences for the plant owner. The WLA Water Leakage Advisor uses advanced process analytics, artificial intelligence and optional special sensors to detect possible leakages in the recovery boiler. The leak index is based on water and flue gas balance models and on anomaly detection to find atypical process conditions that could indicate a leak inside the boiler.

The system is supplied as a turnkey delivery for a new or existing boiler, including installation, commissioning, maintenance services and a remote connection for customer assistance. For leakage detection common process measurements are used, but additional instrumentation that increases the accuracy of the leakage detection is also available.

Benefits

WLA LEAKAGE ADVISOR

- Improved safety of personnel and equipment
- Interactive guidance to verify possible leaks
- Advanced methods used for early detection of leaks

Metris ACE Advanced Control Expert

The introduction of digitalization at pulp mills is proving to bring huge benefits in improving stability and saving operational costs. ANDRITZ has decades of experience of all the processes at pulp mills, as well as many years of experience in applying digital technology. For the recovery boiler, ANDRITZ offers various and increasing levels of autonomy and Metris ACE (Advanced Control Expert) is at the core of digitalization.

OVERVIEW

ACE allows successful optimization of processes by taking responsibility of multiple control and adjustment tasks from the operator. This allows operators to act and optimize recovery boiler combustion and sootblowing processes allowing them to respond to the information provided. Furthermore, with the introduction of Metris Digital Twin, an even higher autonomy of pulp mill processes can take place relieving personnel to concentrate on other value-added tasks related to recovery boiler operation.

The recovery boiler was one of the first areas of the pulp mill where ACE was developed and implemented, and now ANDRITZ has many references globally where the solution is proving vital to managing efficiencies and keeping operating costs to a minimum. The key feature of ACE is to simplify the work of operators, so they have less parameter inputs allowing them to focus on key processes and KPIs. Recovery Boiler ACE™ from ANDRITZ includes two solutions for recovery boiler: Combustion ACE and Sootblowing ACE.

❶ COMBUSTION ACE

The control of combustion in the recovery boiler involves two main stages; control of the fuel added into the boiler, and control of the air management inside the boiler. Combustion ACE is built from two sub controls allowing higher level control of both stages, liquor feeding and total air management.

In both cases, liquor management and air management, Combustion ACE has been designed to optimize and improve the current running of the recovery boiler and thereby making major savings. Other benefits include: increased process and equipment availability, increased equipment lifetime and a decrease in emissions.

Combustion ACE Scope

ANDRITZ online process calculations

Liquor feeding management includes:
- Coordinated production change
- Load control, liquor gun monitoring
- Heat input
- Liquor spraying temperature

Combustion air management
- Total air calculation
- Air distribution and penetration O2 CO

❷ SOOTBLOWING ACE

Sootblowing is often controlled with DCS sequences. These sequences control the intervals of how often each sootblower is used to clean the boiler. Sootblowing ACE enhances the DCS sequence by making the sequence dynamically controlled allowing adjument based on the need for sootblowing, often termed 'on demand sootblowing'.

Fouling calculations take place for each heat transfer surface that needs sootblowing, including superheaters, boiler bank and economizers. Process measurements are used to estimate to how much fouling each heat surface has. Based on these calculations different priorities for different dynamic corrections are used for each area.

Ultimately, this means that sootblowing takes place only when necessary, thereby allowing major savings when it comes to steam consumption. Another major benefit of Sootblowing ACE is that the recovery boiler can be run for a longer campaign, without the need for waterwashing.

Sootblowing ACE scope

ANDRITZ online process calculations include:

Fouling control

Dynamic sequence sootblowing
- Dynamic queue based intervals
- SB's steam pressure and speed profiles
- Boiler load adaptive sooting power
- Configurable sootblowing system structure

Metris ACE:
Sootblowing ACE
Combustion ACE

Benefits

CUSTOM DESIGNED TO ENSURE HIGHER PRODUCTIVITY AND LOWER COST IN RECOVERY BOILER PROCESSES

- ACE manages all the goals of the process areas with the aim to keep higher productivity and lower cost
- Designed to achieve all the Key Performance Indicators (KPI's)
- ACE communicates with DCS layer advising the operator and applying ANDRITZ process know-how into control of the equipment
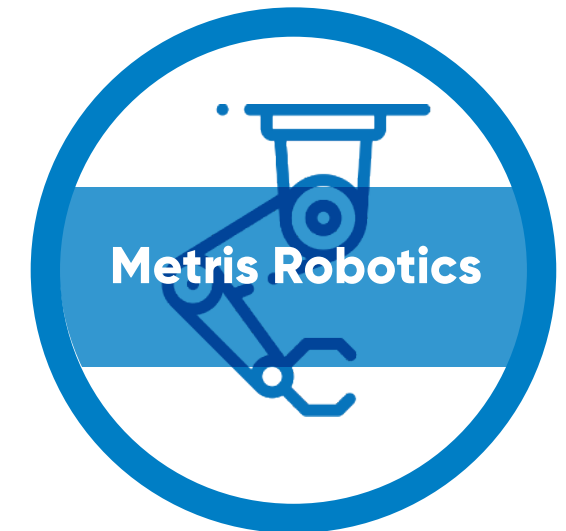- Expert Operator constantly feeds back on processes

Metris smelt spout cleaning system

An automated smelt spout cleaning system will clean and maintain up to three ANDRITZ standard-spaced smelt spouts using one robotic arm. Based on the amount of the smelt spouts, ANDRITZ can deliver the robots to cover all of them.

Metris Robotics

OVERVIEW

The smelt spout area of a recovery boiler is one of the least desirable and sometimes also a dangerous place to work. However, essential regular tasks need to be carried out for efficient and smooth operation of the boiler. Smelt can cause several issues in the spout area as it tends to coagulate and plug the spouts and needs regular cleaning. In most cases, this operation is carried out manually by the operators with long steel rods to remove solidified smelt. Splashing smelt and a hot environment may sometimes make the spout area a hazardous place to be. A combined team of ANDRITZ design experts and workshop engineers have come up with a safer and smart solution - the smelt spout cleaning system - that enables essential work and maintenance to be performed in a harsh environment.

A ROBOTIC SOLUTION FOR A ROUGH ENVIRONMENT

• Placed in front of the smelt spouts
• Operation area isolated behind a safety fence
• Operated via a touch panel

KEY TO SUCCESS

An automated, intelligent smelt spout cleaning system will clean and maintain up to three ANDRITZ standard-spaced smelt spouts using one robotic arm. The robot is placed in front of the smelt spouts, suspended from a steel support structure. The tool on the end of the arm has to be individually customized according to the smelt behavior in the type of recovery boiler concerned.

Safety elements were paramount in the design of the smelt spout cleaning system. The actual working area of the robot is isolated behind a safety fence, and the area is locked and clear of personnel when in operation. In terms of controls, the robot has a local PLC, which handles communication between the DCS and PLC as well as between the PLC and the robotic system. The robot itself can be operated via a touch panel located outside of the safety fence.

Benefits

SMELT SPOUT ROBOT

• Increased personnel and process safety
• Increased availability due to the local or remote control
• More productivity due to less manual work and spout fouling
• Electronic sensor positioning
• Robot covered with protective suit to avoid smelt splashes
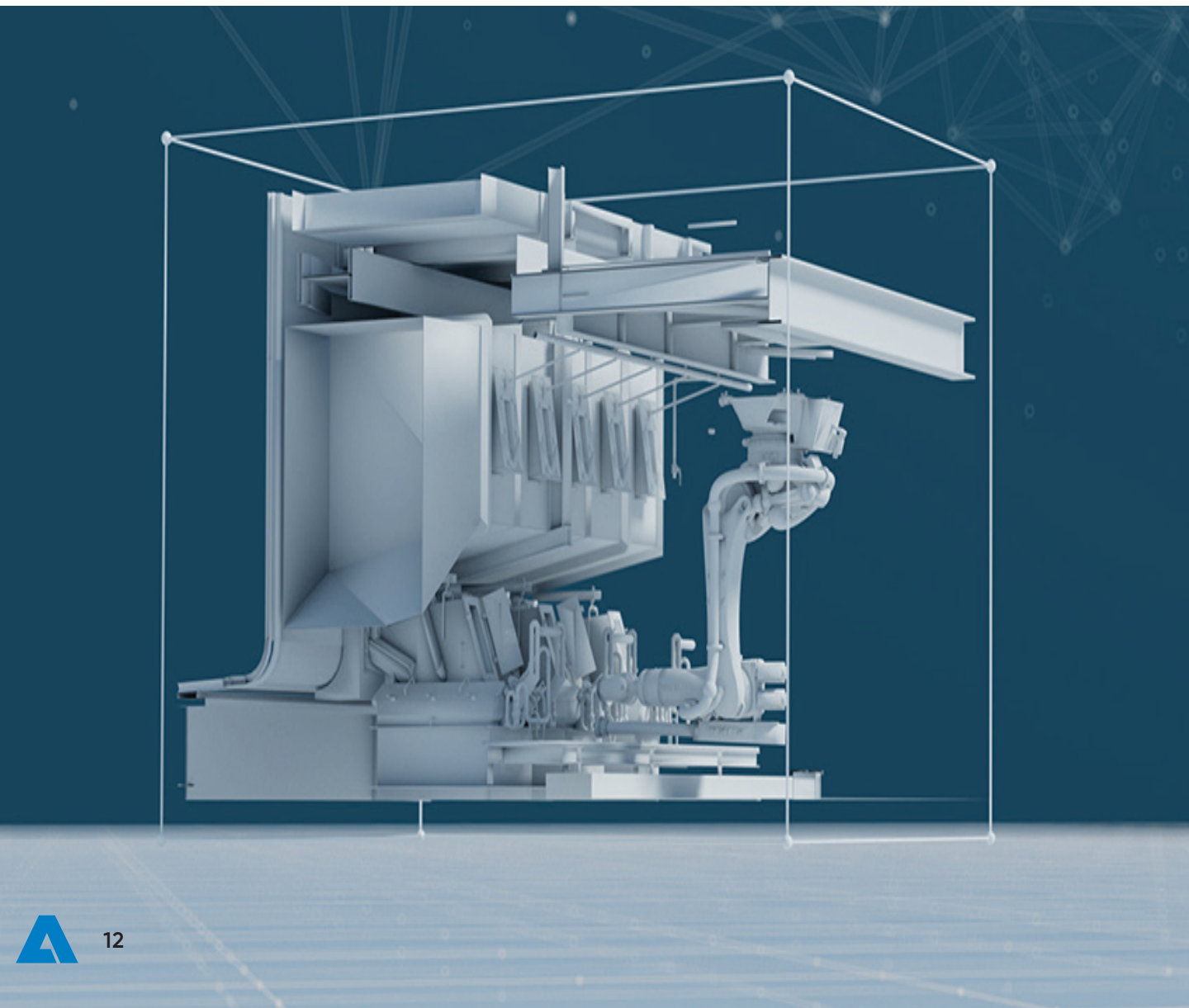
Metris digital twin

Improving your operation with digital twin

OVERVIEW

Metris Digital Twin technology has evolved as an important building block of today's Digital Transformation, unfolding the combined power of process simulations and data analytics. The Digital Twin solution in many ways, complement other automation systems, making them more autonomous. Based on the proven IDEAS simulation platform, with more than 30 years of process and simulation expertise, the Metris Digital Twin solutions offer comprehensive insights for process performance improvement, operational visibility, and proactive decision-making through an informative dashboard all in real-time. Metris Digital Twin transforms the real-time process information along with OEMs knowledge and custom design calculations into more meaningful and actionable steps making it a technical decision-making and advisory platform.

BY 2022, OVER TWO-THIRDS OF COMPANIES THAT HAVE IMPLEMENTED IOT WILL HAVE DEPLOYED AT LEAST ONE DIGITAL TWIN IN PRODUCTION.

ANDRITZ has been offering digital twin technology for offline applications for more than 25 years to drive operational readiness. Now, we extended our technology to online applications to drive operational excellence. The very objective behind the solution design is to improve, maintain and highlight the process performance based on real-time data.

WHAT IS A DIGITAL TWIN?

The Metris Digital Twin represents a digital replica of the physical process using asset-specific information such as actual physical dimensions and equipment characteristics. When connected to online plant data, the Metris Digital Twin acts like a performance information tool similar to an MRI of the human body—both can be used to find otherwise undetectable anomalies and highlight the gaps between actual and optimal operation.

The Metris Digital Twin runs in parallel with your operations, continuously calculating key process parameters which sometimes cannot be measured or are difficult to measure by traditional instrumentation.

The Metris Digital Twin, through its proven simulation capabilities, combined with live plant data as an input provides virtual transmitters, calculates optimal setpoints, and perform what-if scenario analysis. The data reconciliation helps with online model correction and replaces faulty measurements with plausible values.
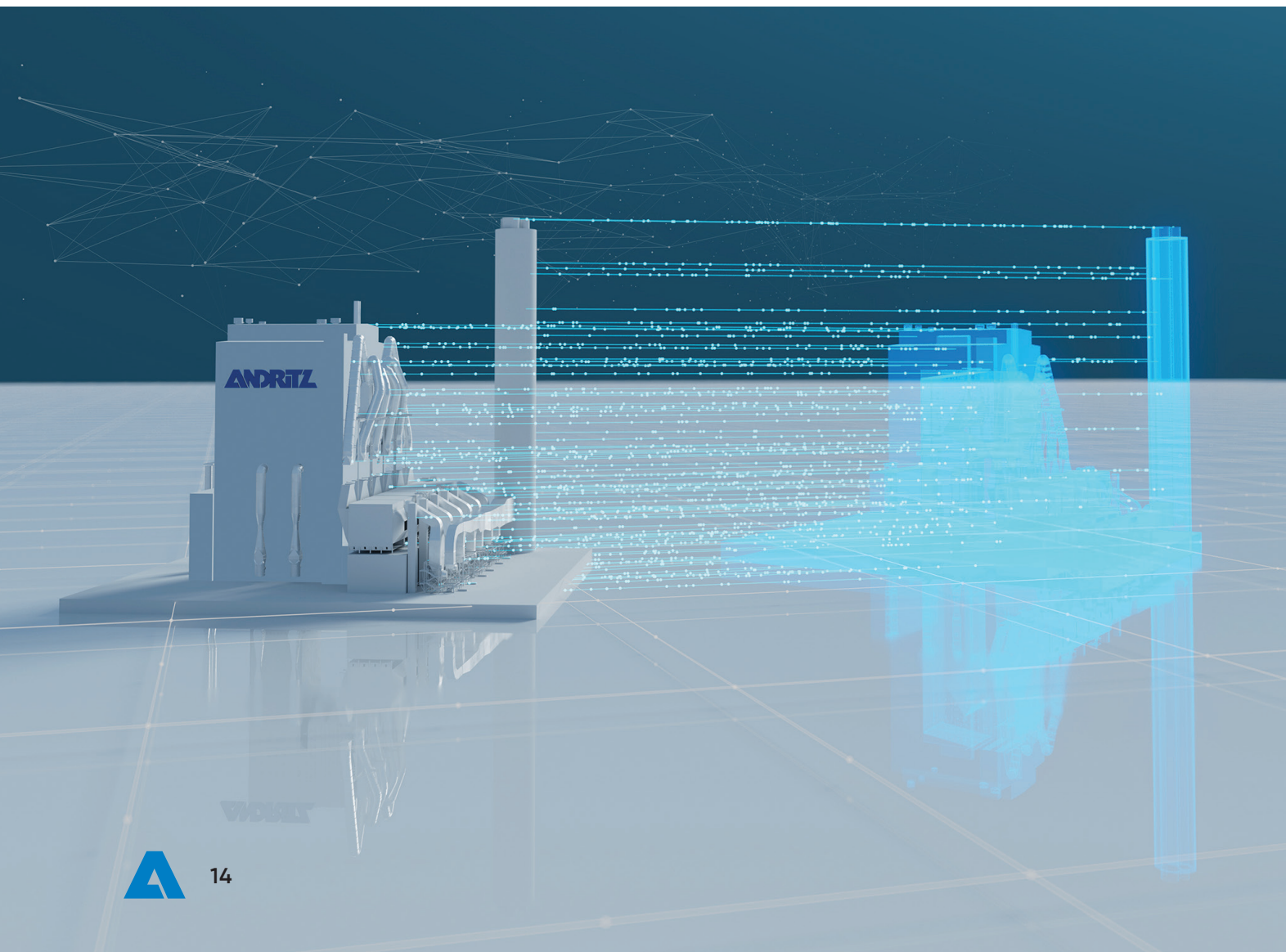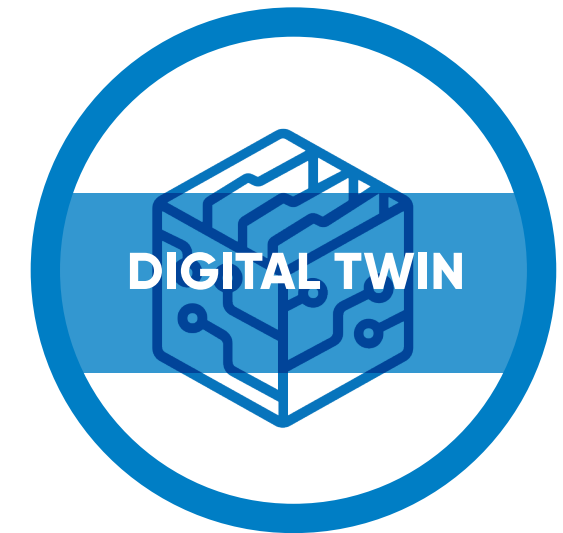
DIGITAL TWIN

Benefits

DIGITAL TWIN

- Real-time application
- Complements advanced process control
- Anomaly detection
- Virtual transmitters
- What-if scenarios
- Inventory and production calculations
- Operational guidance
- Building block for digital transformation
- Data reconciliation
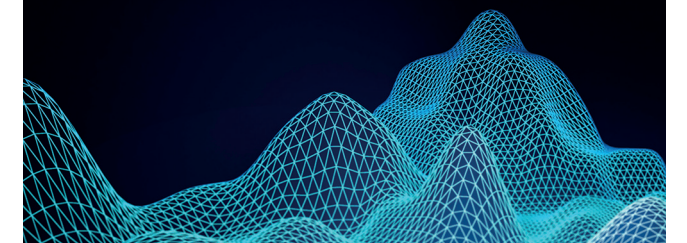
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