

### **Process Automation**

A quickly growing market with structural tailwinds and investment opportunities December 2021





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  - Condition-based / predictive maintenance
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### **Executive summary**

- Automation is playing a key role in all industrial markets. In particular, process automation has seen an increase in popularity, as it enables a broad range
  of companies to reduce costs and waste and enhance outputs. Based on current trends, this market is expected to see substantial growth in the coming
  years and provide a range of opportunities for investment and value creation
- Process industries (such as Oil & Gas, Power Generation, Mining & Metals, Chemicals, Food & Beverage, Healthcare & Pharma, and Water & HVAC) are being impacted by five overarching megatrends, including the introduction of **new environmental regulation**, increasingly **stringent health and safety standards**, mounting pressure to **reduce costs while improving quality**, and **labor shortages**. These megatrends present diverse and significant challenges across industries and **accelerate the adoption of automation technologies**
- New process automation applications are emerging these address key megatrends and are enabled by new digital technologies (such as sensor technology, connectivity / cloud infrastructure, cybersecurity, and analytics). Examples of these applications include:
  - Predictive maintenance (e.g., on gas turbines) where Asset Performance Management solutions have emerged to optimize the trade-off between
    asset availability and utilization based on analysis of centralized test data to monitor and predict condition
  - Emissions Management Systems (e.g., in petrochemical plants) reduce operational complexity but critically ensure compliance with environmental
    regulations where process industries generate a significant share of greenhouse gas emissions
- Winning companies in process automation have high levels of IP, regular innovation capability, global aftermarket presence, and offer synergistic softwarebased solutions
- Overall M&A activity has been strong over the last five years with over 500 transactions in process automation. Investors are looking for both end-market diversified and product-specialized companies. They value highly specialized niche players with extraordinary engineering capabilities and exceptional margin profiles. There is an increasing demand for IIoT solutions across all sectors
- To illustrate where the market is now and where it is going: The global process automation market was worth roughly \$85 billion in 2020, but it is expected to be worth around \$115 billion by 2025. Therefore, this level of growth is expected to attract the attention of many OEMs entering new markets, as well as financial investors interested in consolidating the market



### The growing industrial automation sector comprises 3 key subsectors that cover multiple industrial end-industries





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### The global process automation market is growing rapidly, driven by a range of structural drivers. 85% of the process automation market is focused on six key sectors



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Source: L.E.K. research and analysis; Morgan Stanley; Markets and Markets; Credit Suisse CONFIDENTIAL

### The landscape of companies in the fast-growing process automation tech stack is broad



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#### Source: L.E.K. interviews and analysis CONFIDENTIAL

# Process industries are being impacted by overarching megatrends, which create significant challenges for businesses to overcome

	Relevant megatre	nds	Impact on process industries				
	Environmental sustainability	Growing global concern for the climate crisis is driving more stringent regulations and increasing pressure from shareholders and consumers for eco-friendly processes	Increasingly stringent environmental regulations and requirements to <b>control / reduce emissions</b> Growing shareholder and consumer pressure to have <b>sustainable production processes</b> Drive to reduce cost of renewable energy to make it <b>cost competitive</b> with other energy sources				
	Health & safety	Increasing government and corporate focus on employee and general public health and safety	Minimize exposure to hazardous chemicals and toxic substances Reduce risk of physical injury (e.g., operating dangerous equipment, etc.) Reduce exposure to dangerous environments (e.g., underground, in oil rigs, etc.)				
р <mark>о</mark> с	Operational efficiency	Continued focus on sustaining and improving profitability by taking cost out of production processes as many sectors are mature	Sustain or improve profit margins, particularly in mature industries with more limited growth Avoidance of unplanned maintenance and unnecessary downtime reducing output Requirement to update aging infrastructure to increase efficiency and improve processes				
<b>S</b>	Quality improvement	Drive to consistently improve and produce high-quality end products through enhancements in quality control processes	Increasingly stringent regulatory requirements to ensure <b>high-quality</b> levels of output Increasing consumer pressure regarding the <b>quality of output and processes</b> <b>Reduce wastage and cost</b> from rejected or faulty output				
iii	Labor shortage	Growing labor shortages due to an aging workforce, recruitment challenges, and the resultant risk of knowledge loss as people retire	Aging population and low birth rates affecting <b>demographic and size of available workforce</b> Lack of expertise and industry knowledge among upcoming / future workforce				

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## The key megatrends, enabled by advances in digital technologies, are resulting in several process automation applications





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### These new process automation applications are being deployed across the six key industry sectors. Two of these applications are explored further in this reader

Examples of new applications of process automation across key industry sectors							
<ul> <li>Key applications explored in this paper</li> </ul>							
	<b>o</b> o	(1) Condition-based / predictive maintenance	2) Emissions Management Systems	Smart production processes	Automated health and safety systems	Automated monitoring systems	
百	Oil & Gas	Use of CMMS to implement preventive maintenance and increase uptime	Emissions monitoring and flare management across upstream and downstream	Increased exploration effectiveness by identifying formations for further analysis	Detection of flammable and toxic gas		
000	Power Generation	Better management of failures using APM software	Emissions monitoring for waste incineration and other combustion processes	Optimized grid operations to handle demand peaks and intermittent renewables			
•••	Chemicals	Condition monitoring of critical equipment to reduce downtime risk	Continuous in-line emissions monitoring of a range of specific chemicals depending on sub-sector	Continuous level, pressure, and flow monitoring within automated control loop	Reduced risk using real- time environmental toxicity detection systems	Wider adoption to assess batch quality and identify anomalies, reducing waste	
S.	Healthcare & Pharma	Predictive analytics to identify maintenance needs in equipment that degrades e.g., MRI scanners		Faster, more efficient quality control and production processes	Automated dosage formulation and filling processes	Reduced human exposure to higher potency APIs with use of sensors	
	Food & Beverage	Monitoring of process plant increasing reliability and reducing maintenance costs		Robotic systems to improve production efficiency and quality and reduce waste			
0 0	Mining & Metals	Enterprise asset management using data from various on-site assets		Advanced analytic tools to inform decision-making without risking human life	Flammable and toxic gas detection in areas humans are required to work		

Source: L.E.K. research; Industry Press; ABB; Pangea CONFIDENTIAL



Sophistication of asset maintenance has been increasing, moving from preventive to condition-based and predictive maintenance based on asset health indicators

💑 Condition-based / predictive maintenance

### **Evolution of asset maintenance regimes**

	Increasing level of sophistication					
	O Ba	ased on pre- t schedule	Informed by data on equipment condition			
	Run to failure	Preventive maintenance	Condition-based maintenance		Predictive maintenance	
			Manual	Automated	Static rule	Machine learning
Time of maintenance	After failure Before failure Before failure		failure	Before failure		
Sensing and data collection method			Manual / handheld devices	Integrated sensors	Integrated	sensors
Monitoring frequency			Periodically	Continuously	Continu	ously
Analysis method			Human-based analysis (by experience and engineers)		Static rules- based analysis	Al-based analysis
Maintenance trigger	Failure	Schedule	Breach of critical asset health indicator		Predicted health or risk score	Predicted remaining useful life

Source: Trade press; L.E.K. research; L.E.K. study CONFIDENTIAL

- Asset managers have gradually migrated from preventive maintenance to condition-based and predictive maintenance, driven largely by improvement in asset uptime, utilization, and cost savings
- The **key benefits** of condition-based maintenance to utility customers include:
  - Lower maintenance costs
  - Lower risk of damaging faults, such as explosions
  - Increased uptime and overall asset performance
  - Tighter and more cost-effective tracking / reporting on compliance requirements
- Adoption has been more gradual to date, due to a number of impediments:
  - Cybersecurity concerns
  - Concerns about information overload
  - Conservative nature of many asset-intensive businesses
- The condition-based maintenance market is estimated at \$2bn, growing by 12% annually, driven notably by emerging markets



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# Asset Performance Management solutions have emerged to optimize the trade-off between asset availability and utilization based on analysis of centralized test data to monitor and predict condition

💑 Condition-based / predictive maintenance

#### APM, EAM, and CMMS key functionalities and capabilities



- Asset Performance Management (APM) is the optimization of the trade-off between asset availability and asset utilization. The associated software is part of enterprise IT platforms
- APM enables utilities to lower maintenance costs and risk of damaging faults, increase uptime, and navigate regulatory compliance further than with condition monitoring only
- The APM value proposition includes:
  - **Centralized online monitoring software,** which consolidates and analyzes the online and offline test data
  - **Asset-specific analytics** which include root cause analysis and fault prediction
  - 3 Health index analytics, which use asset condition and risk to drive activities from ST maintenance to LT capital replacement strategies
  - Enterprise software integration (CMMS / EAM) for automated updated maintenance priorities / impact on investment cycle
- The APM market is quite nascent with an estimated market size of \$200-250m in 2020 globally, growing at 10-15% p.a.



# To provide effective condition monitoring, multiple online and offline testing technologies need to be combined

#### Condition-based / predictive maintenance

Partial Discharge Monitor **Bushing & PD Other Hardwired** Monitor Sensors placed on Transformer Cooling Sensor on Control OLTC / RTCC Dissolved Gas Analyzer Transformer **Fiber Optic Control Cubicle** Sensors placed inside the Transformer

#### Example: Transformer monitoring system and data acquisition

#### Benefits of combining online and offline tests



<u>Improved / more accurate analytics</u>, due to the combination of offline tests and online data, to identify root causes as well as make better choices when specifying new equipment



**<u>Consolidated data</u>** is easier to analyze and maintain, while also enhancing security and ease of regulatory compliance



Interpretation of combined online and offline data requires specific **<u>capabilities and domain experience</u>** to make the right diagnosis and correct bias



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Process industries significantly contribute to greenhouse gas emissions, which are driving / stimulating development of sophisticated Emissions Management Systems (EMS)

Emissions Management Systems

### Drivers of the development and adoption of Emissions Management Systems



Emissions Management Systems (EMS) monitor, report, and control energy usage and emissions of harmful pollutants from industrial activity



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# Managing the process industries' significant contribution to greenhouse gas emissions requires alternative fuels or reducing the footprint of existing activities through automation

Emissions Management Systems

#### European greenhouse gas emissions by sector

#### (2017)

Millions of kt CO<sub>2</sub>; percent



Source: European Environment Agency CONFIDENTIAL

### Use of alternative fuels / energy sources

- 1. Change power sources (e.g., replacing generators with solar PV and battery technology)
- 2. Electrify equipment
- 3. Use green hydrogen

### Reducing footprint of existing activities

- 1. Improve energy efficiency
- 2. Reduce fugitive emissions
- 3. Reduce flaring activities

Automation technologies can support **process optimization** and **regulatory compliance** through:

- Automated emission monitoring in the process
- Machine learning / AI to improve process efficiency and reduce emissions
- Condition monitoring / Asset performance management to improve equipment efficiency and reduce emissions





Automation of emissions measurement plays an important role across multiple industries both for regulatory compliance and optimizing the underlying process

Emissions Management Systems

Key end-markets requiring emissions management



Oil & Gas



Petrochemical



Chemical



**Power generation** 



#### Hydrogen production

#### Examples of potential for automation

Optimization and emissions reporting for waste gas removal flaring from gas separation processes and GHG emissions Emissions reporting using environmental toxicity detection systems in production environments Optimization and reporting of gas release / burning during unplanned over-pressuring of plant equipment Optimization of combustion processes through continuous monitoring of combustion flue gases to control fuel input flows and optimize fuel efficiencies Emissions monitoring from various methods of hydrogen production, including natural gas reforming and coal gasification



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**Example:** Continuous Emissions Monitoring Systems (CEMS) are used to measure waste gas for regulatory compliance and optimize processes to both improve efficiency and reduce emissions

**Emissions Management Systems** 

Illustration of Continuous Emissions Monitoring Systems (CEMS)



### **Operation and benefits of CEMS**

CEMS can use a combination of extractive and in-situ systems to measure emissions using gas sensors



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Depending on the configuration, systems may use individual sensors for each gas (e.g., parametric, TDLS), or use multi-gas sensing technologies (e.g., FTIR). Gases typically measured using CEMS include CO, CH<sub>4</sub>, CO<sub>2</sub>, NOx, SO<sub>2</sub>, VOC, HCl, HF, NH<sub>3</sub>, H<sub>2</sub>O, and Hg

Analyzers convert the sensor outputs into gas composition data

Gas composition data is used to:

- Monitor emission levels to ensure regulatory compliance
- Feed back into the plant control systems in order to understand and optimize plant processes to maximize efficiency and reduce emissions



Source: L.E.K. research and analysis; Industry press CONFIDENTIAL

### Common themes and strengths in leading companies across segments of the process industry automation space



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Process automation can help address five key megatrends that should underpin structural growth across geographies and benefit from increased focus on sustainability



Innovation leaders typically have high levels of IP and annual R&D spend, have more regular new product offerings, and therefore command higher margins, as they can protect and grow their leading market positions



Companies with leading market positions in their respective sectors and subsectors, due to technology and unique product offerings, **command higher prices** 



Software enabled / connected products for monitoring and productivity improvements are highly sought-after as long as security protocols ensure data protection



Customers increasingly are asking for "global solutions" to simplify their production and supply chains, including local service offerings. As such, they become an integral part of the customer's value chain with high levels of customer stickiness



While Europe and North America combined comprise the largest share of the global automation market, the Asia Pacific share of the overall market will grow rapidly over the next five years



~50% Companies using automation for mission-critical processes in 2019

7%+ Global process automation market growth 2020-2025

~74% Organizations looking for new use cases for process automation



Strong customer demand for process industry automation assets with resilient business models driving M&A activity across all industries after the outbreak of COVID-19



### Increased M&A activity expected in process automation over the next 12-24 months





**Strong bounce-back of M&A activity in the process automation sector in 2021**—after a 30% decrease in 2020 due to COVID-19, investors are looking for both end-market diversified and product-specialized companies



Furthermore, we observe strong strategic interest in highly specialized niche players with extraordinary engineering capabilities and exceptional margin profiles to complement corporate product portfolios and strengthen their positioning in key markets



Besides strategic investors, there remains a **constant interest from private equity** in this space with **around 25% of all transactions ending up with financial buyers** 





We expect an **increased level of M&A activity** in the process automation space over the next 12-24 months driven by **increased OEM investments** across multiple end markets and **corporate divestitures of non-core businesses** as a result of portfolio reviews in the wake of COVID-19



Many companies have already automized their processes but do not have fully digitized processes and solutions. Therefore, we expect **an increasing demand for IIoT solutions** across sectors



Process automation valuation levels have continuously increased over the last decade, **with current valuation levels around 12-14x EBITDA**. Infrastructure critical verticals achieve higher valuation levels with a **strong valuation growth over the last 2-3 years** 

Notes: Diversified includes transactions with targets focused on Metals & Mining sectors, as well as targets with diversified customer verticals Source: Mergermarket CONFIDENTIAL



## In the last five years, publicly listed process automation companies have traded between 10x to 13x NTM EBITDA

#### PROCESS INDUSTRY AUTOMATION COMPANIES - PUBLIC COMPARABLE MARKET PERFORMANCE BY KEY CUSTOMER END-SEGMENT



Notes: Industrials include end-markets such as Oil & Gas, Chemicals, Pulp & Paper, and Mining & Metals; Utilities include end-markets such as Power Generation, Water & HVAC Source: CapIQ as of November 1, 2021 (incl. available broker notes); Company websites CONFIDENTIAL



### In the coming months, look for additional, detailed reports on factory and warehouse automation





Winter 2021 / 2022





### We span a global network of experts and look forward to connecting with you to share our experience in the automation sector





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