FME AI FOR INDUSTRY JAAREVENT

Optimalisatie Planning, Productie en Energieverbruik met AI

11 december 2024

FME POWERED BY DUTCH TECHNOLOGY

FME PLATFORM AI FOR INDUSTRY

AGENDA

1. Ionuț Barbu – Bright Cape:
   Energy optimization in the process industry
2. Jurgen Bastiaansen – Festo:
   AI in Engineering – from an industry perspective
3. Vragen & discussie

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Energy optimization in the process industry

Ionuț Barbu, Lead Data Science

BRIGHT CAPE

FME AI for Industry Jaarevent

11 December 2024

Who is Bright Cape?

What defines Bright Cape	• Well informed (thought leader) • Always in control • Efficient en effective • Result orientated en pragmatic • No nonsense • specific domain- en sector expertise
What do we offer	Process improvements through data-driven solutions which can be delivered end-to-end
Where do we play	Logistics & Warehousing Banking & Finance Manufacturing Energy

BRIGHT CAPE

End-to-end approach to actively provide added value

Phase	Explore	Extract	Embed	Educate
	discover & connect	*insight & enablement*	*take action & realize value*	*learn & sustain*
Characteristics	• Understanding the client and their challenges • Guiding the client in options for using their data	• Identifying patterns, bottlenecks & inefficiencies • Create insights and extract value out of the data	• Using insights for sustainable solutions • Continuously obtain value by embedded solutions	• Transferring knowledge to stay fit for the future • Building & keeping your own knowledge center
Value	Increase reliability, Increase quality	Sustainability and Footprint reduction	Reduce costs, Increase revenue	Reduce bottlenecks and lead times, remove inefficiencies

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Energy crisis in Europe impacts manufacturing

Germany's industrial production expected to sink further

04/22/2024

German industrial production is expected to fall further behind this year, after a dip in 2023. The usually strong manufacturing sector had already taken a hit because of higher energy prices.

Rising energy prices affect the Spanish steel industry – Unesid

Europe pins hopes on mild winter to avoid worse energy crisis in 2023

Energy crisis has disruptive effect on Dutch manufacturing

The costs of Italian steelmakers for electricity may increase by 35%

Energy crisis poses threat to Europe's industrial sector

EU faces 'make or break moment' for green transition, report says

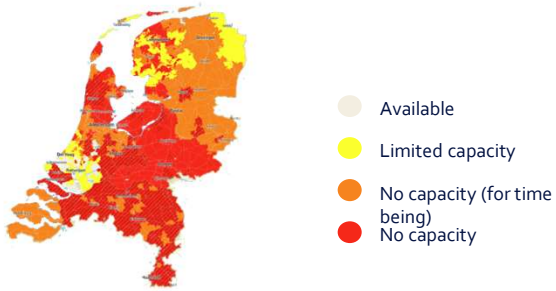
Energy Crisis: Are Industrial Manufacturers Sustainable Enough To Tackle It?

Addressing the grid congestion challenges can help manufacturers in multiple ways

Context

Energy is a key resource for many companies to maintain processes running. As the world is facing an energy crisis highlighted by the ongoing grid congestion, organizations are being forced to take a more active role in their energy management.

The increased demand, supply volatility and high energy costs emphasize the need for a transition towards more sustainable energy sources. At the same time, stay in control of energy resources to help stay competitive.



Demand
purchase of electricity [1]

Benefits for manufacturing

Energy represents a significant share of the operational and production costs. Therefore, manufacturers are seeking for solutions to effectively manage their energy footprint.

- Increase energy independence
- Reduce energy costs
- Reduce environmental footprint
- Increase compliance with regulations

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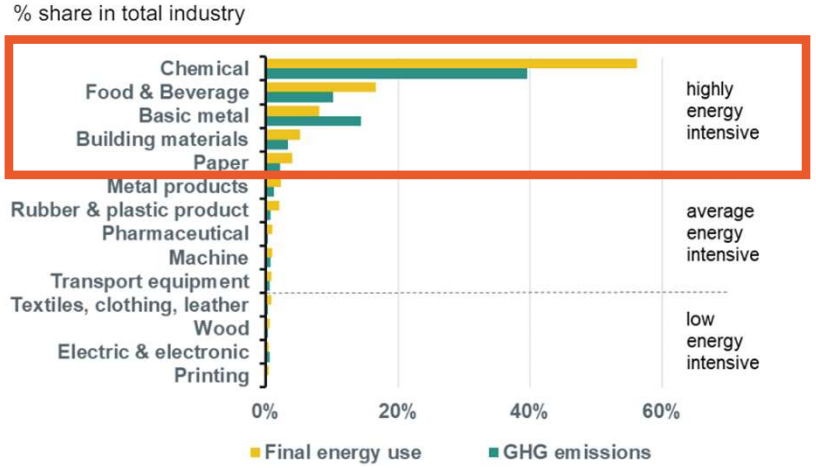
[1] Netbeheer Nederland (2024)

5 industries stand to benefit the most from energy optimization initiatives

GHG and energy intensity subsector industry [2] (2022)



Impact of grid congestion on manufacturing

The manufacturing sector, particularly the energy-intensive industries, faces challenges in increased energy costs and operations expansions, caused by grid congestion. In order to expand operations, it could take of up to five years or more for new heavy grid connections (Netbeheer Nederland).

Energy-intensive industries have a substantial impact on both final energy consumption and greenhouse gas emissions. Combined, these subsectors account for:

90%
of total energy consumption in industry[2]

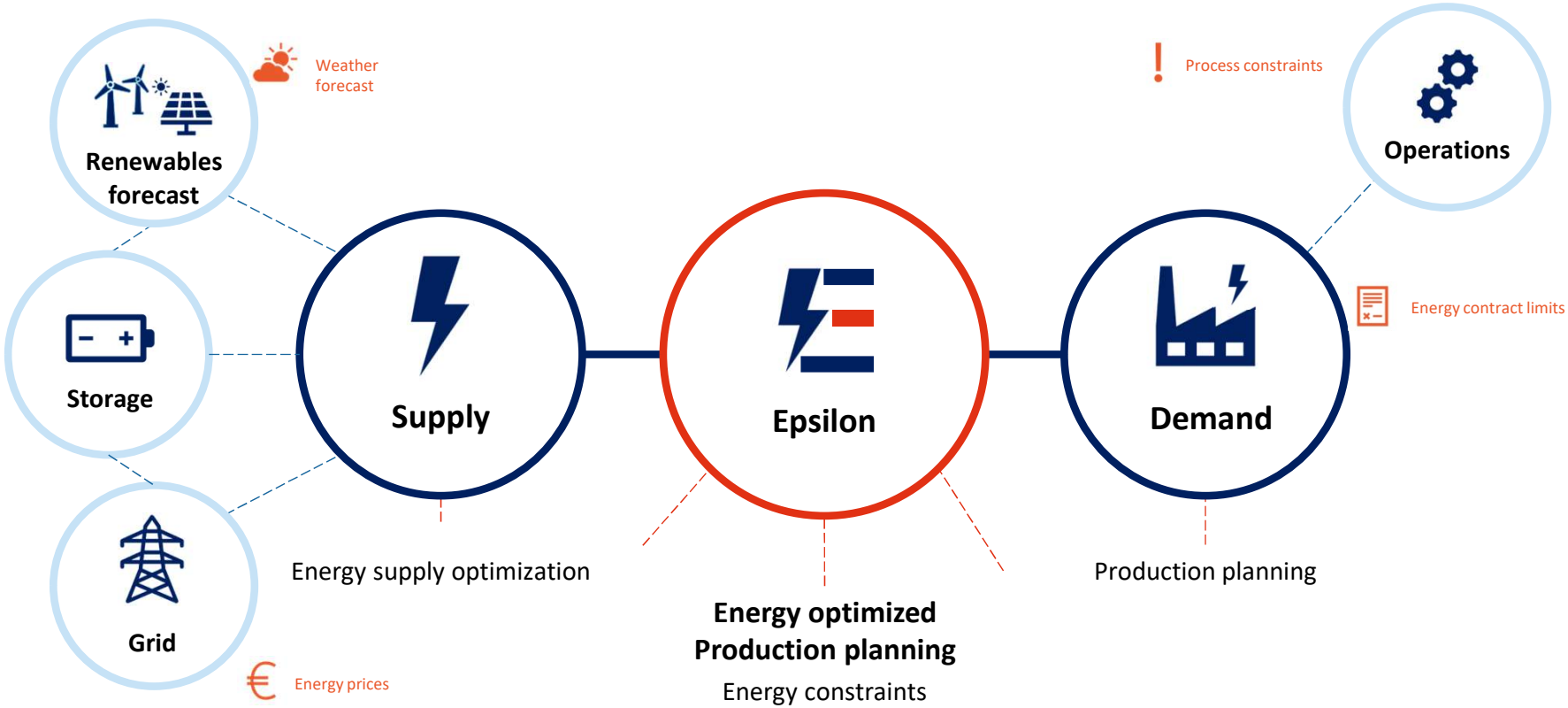
94%
share of total industrial GHG emissions[2]

Top 5 industries by % share in total energy use

Chemical industries	Food & Beverage	Basic metals	Building materials	Paper
55 %	18%	8%	5%	4%

[2] ABN ESG Economist (2024)

Our solution optimizes industrial production planning under energy constraints



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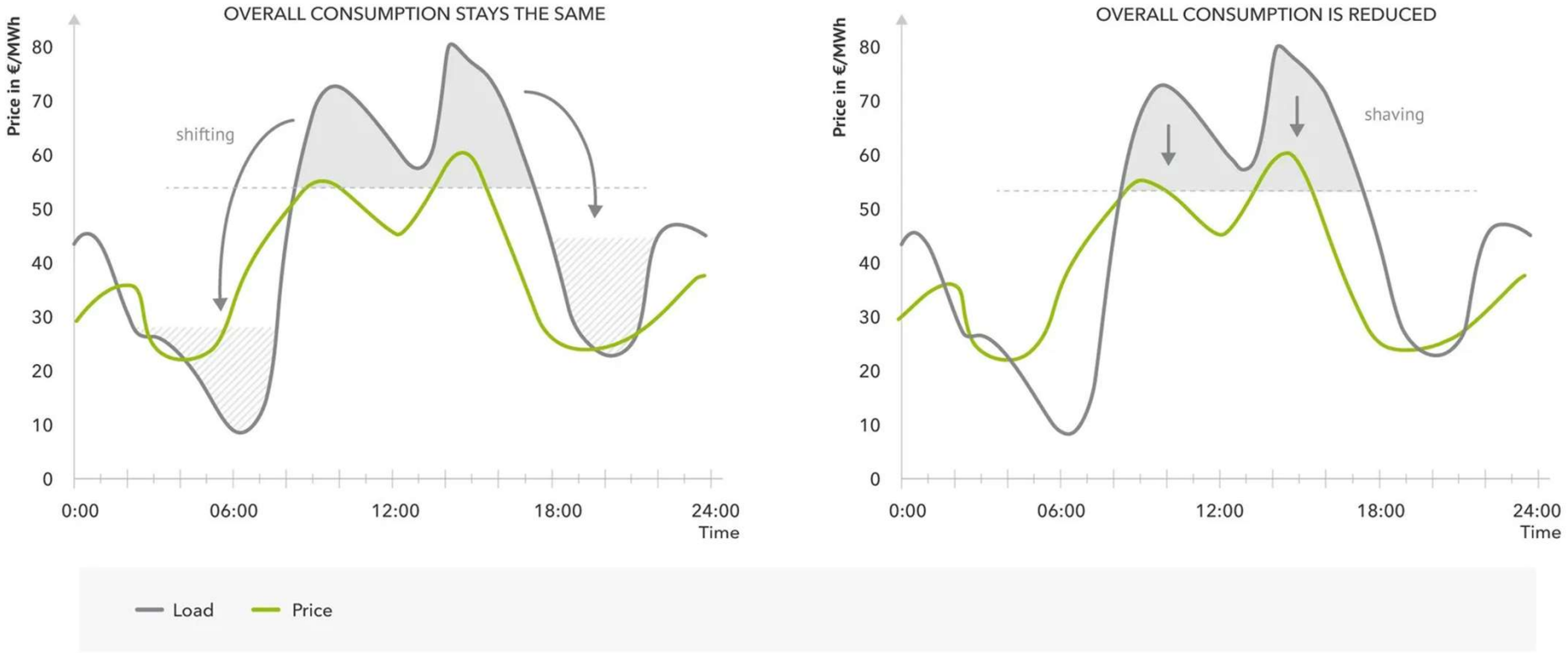
Load shifting vs peak shaving

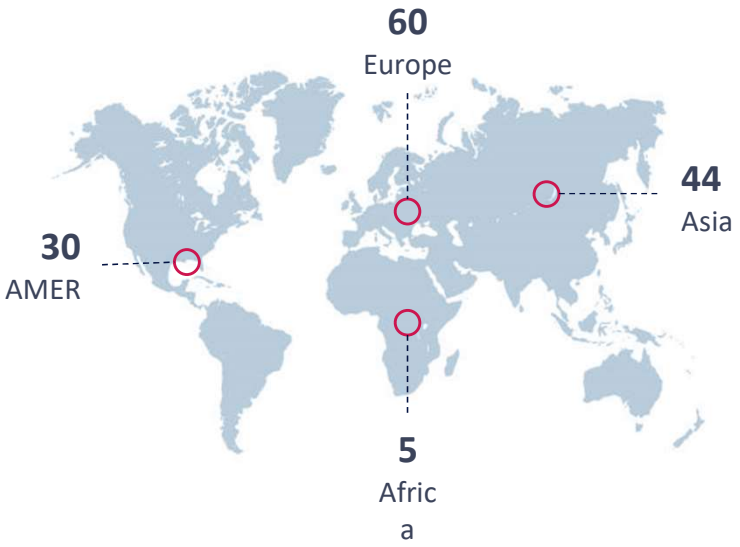
Two different ways for demand-side management



https://www.next-kraftwerke.com/knowledge/what-is-peak-shaving

Energy supply optimization at European steel producer

- **Mission**
  - Carbon neutral in 2050
  - 35% reduction in 2030
    - *"Currently don't have any other lever to save CO2/energy costs"*
- **Scope:** value added locations
  - Some already considered PV
  - Consider storage systems



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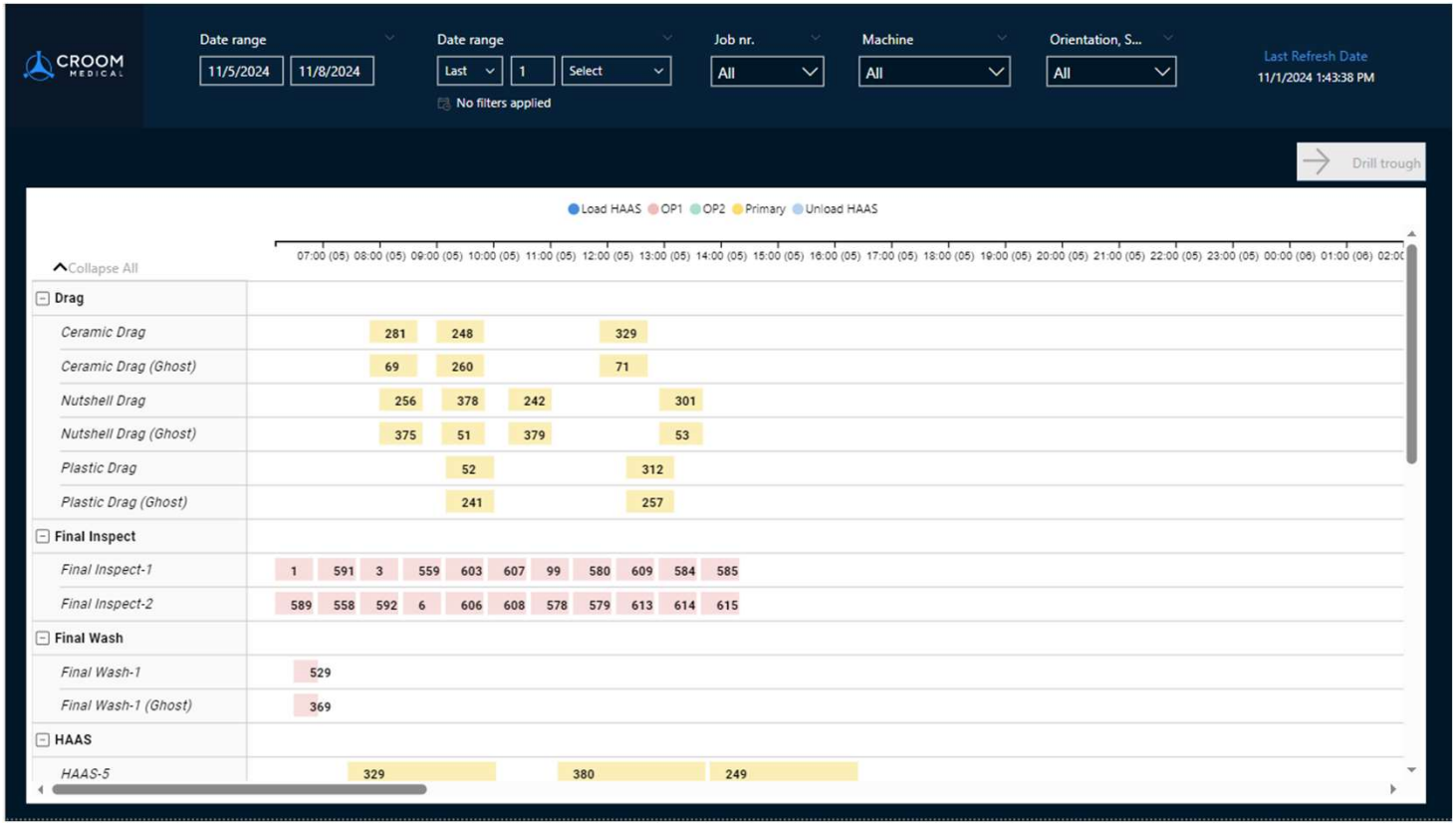
Let's see peak shaving in practice

Production planning optimization at European MedTech company



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Thank you

Bright Cape B.V.

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The Netherlands

AI in Engineering

(from an industry perspective)

Jurgen Bastiaansen
Manager Innovation Unit @FESTO

Agenda

- → FESTO at a glance
- → AI: from Bionics to Industry
- → Smart technology and products
- → Applied technology for the future?

Family owned company
Motion is our DNA
R&D
Innovation
Education
Responsibility
Worldwide presence
FESTO
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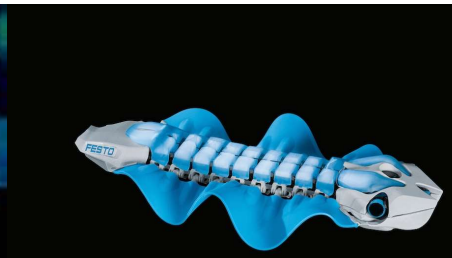
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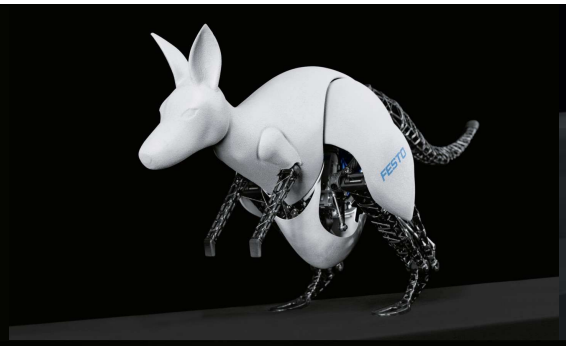
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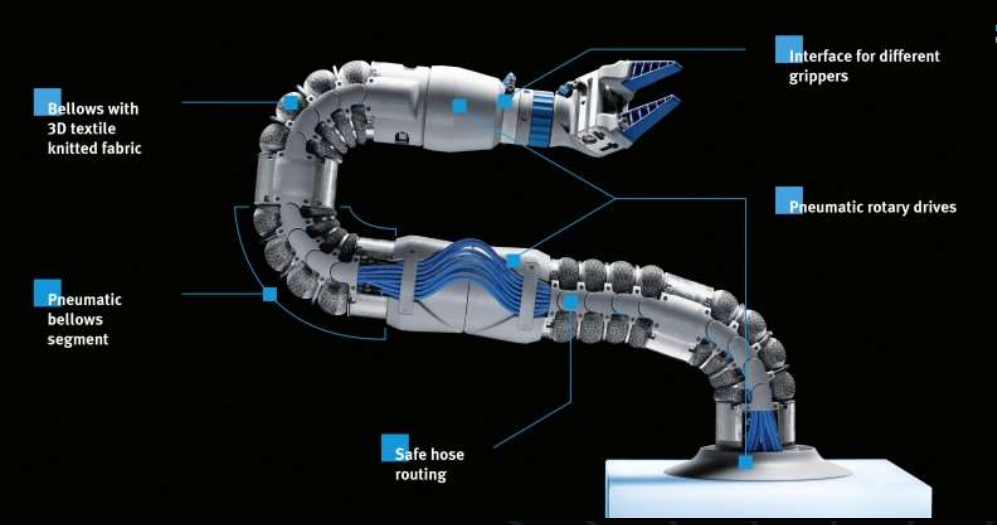
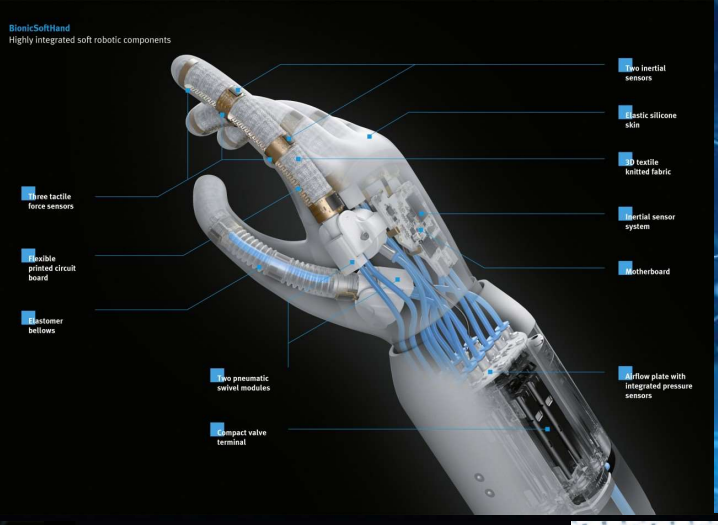
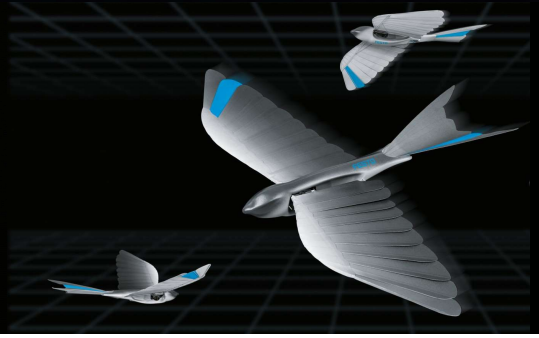
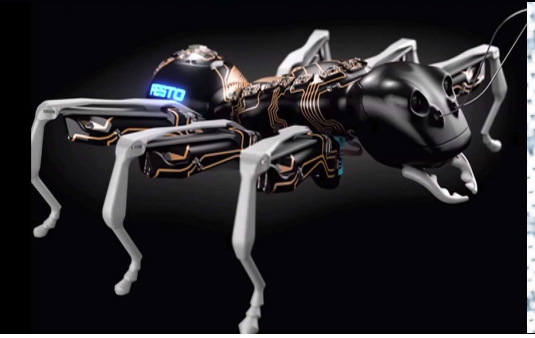

Bellows with 3D textile knitted fabric
Interface for different grippers
Pneumatic rotary drives
Pneumatic bellows segment
Safe hose routing


BionicSoftHand
Highly integrated soft robotic components
Two inertial sensors
Elastic silicone skin
3D textile knitted fabric
Inertial sensor system
Motherboard
Airflow plate with integrated pressure sensors
Three tactile force sensors
Flexible printed circuit board
Elastomer bellows
Two pneumatic swivel modules
Compact valve terminal

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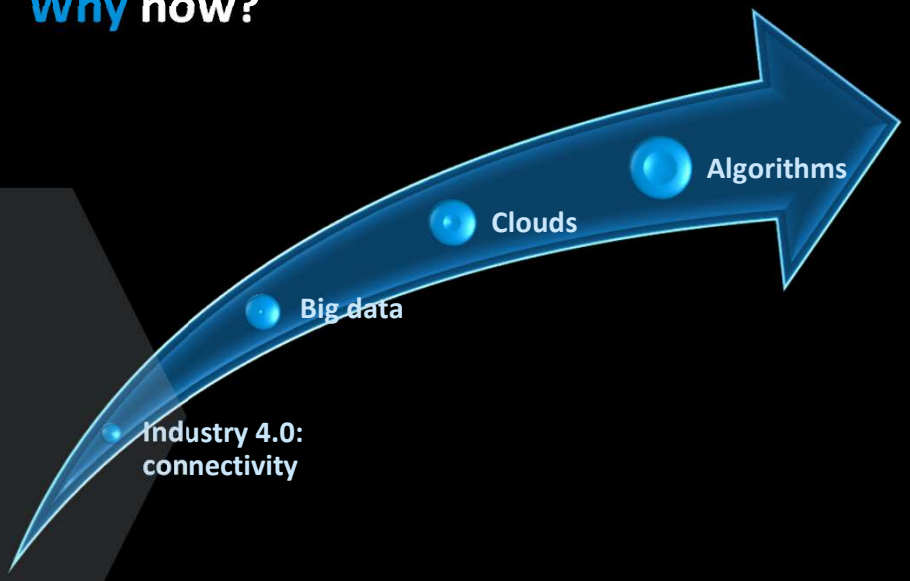
The momentum of Artificial Intelligence:

Why now?



Technological Evolution and/or Social Revolution

"In fact, research found that 75% of B2B buyers prefer a rep-free sales experience"

(source: Forbes: the new buyer's journey: how to win over informed B2B customers. www.forbes.com

Fetch. ai: "AI Agents can negotiate and transact on your behalf"

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Artificial Intelligence:

…and what it means for us

1. Technology isn’t the limiting factor…
2. Boundaries: ethical and social acceptance
3. No progress without the possibility of failure
4. B2B & AI: Disruptive or Opportunity?

16% use AI and succeed
64% use AI and fail
29% don’t use AI
Source: World Economic Forum, 22nd April 2024. www.weforum.org

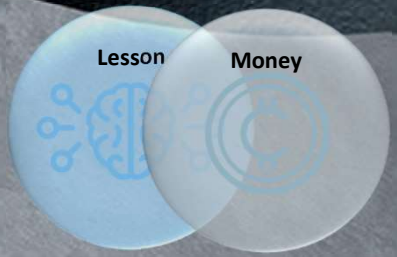
It’s up to us

Possible pitfalls

Skipping front-end homework: “Do you have an existing model that brings us benefits”

Too narrow definition of succes: “It HAS to have an ROI”

Searching for one-fits all: “Is there an existing model of Festo products”

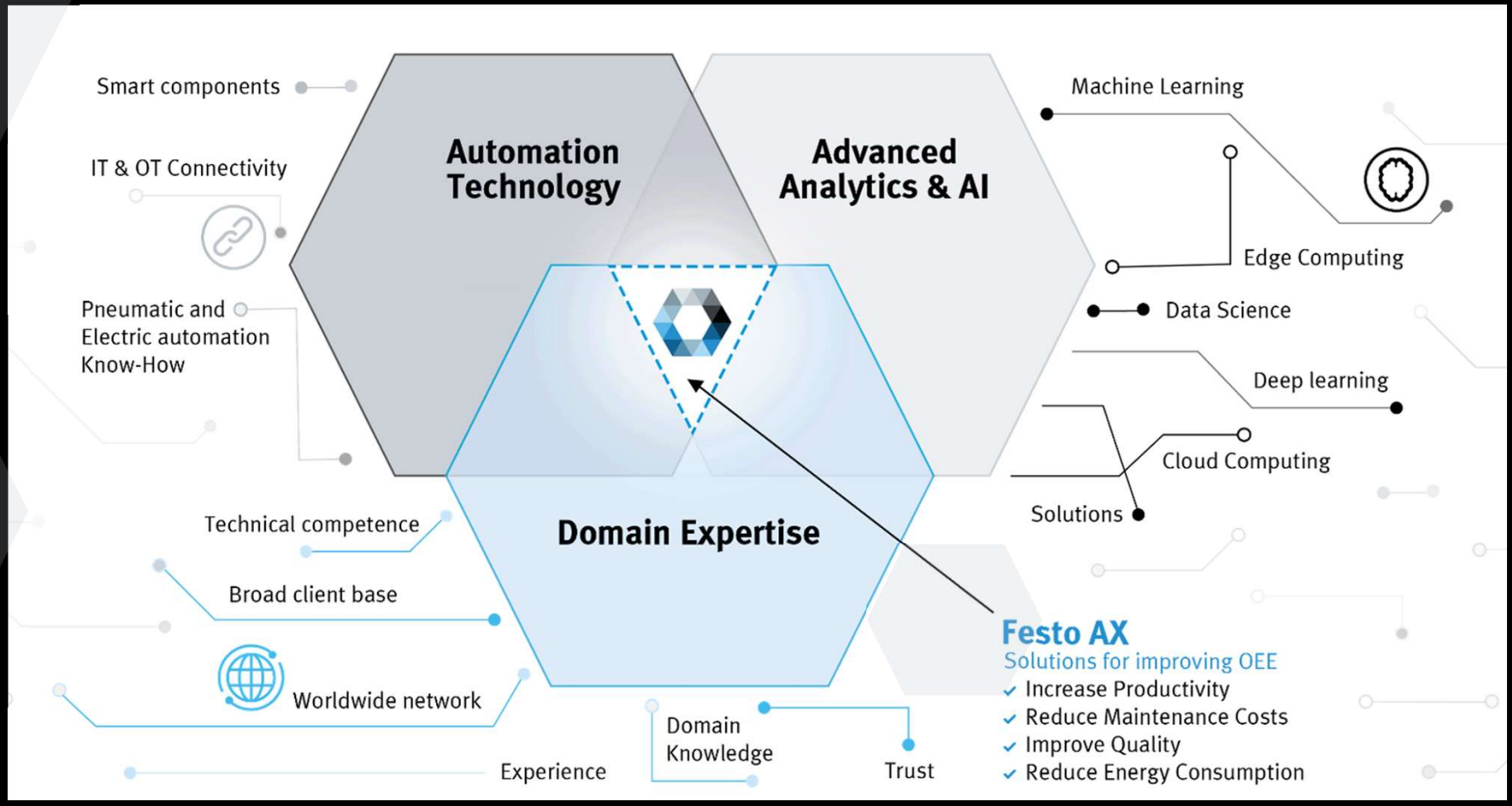


Shortcuts to success are usually fast lanes to failure

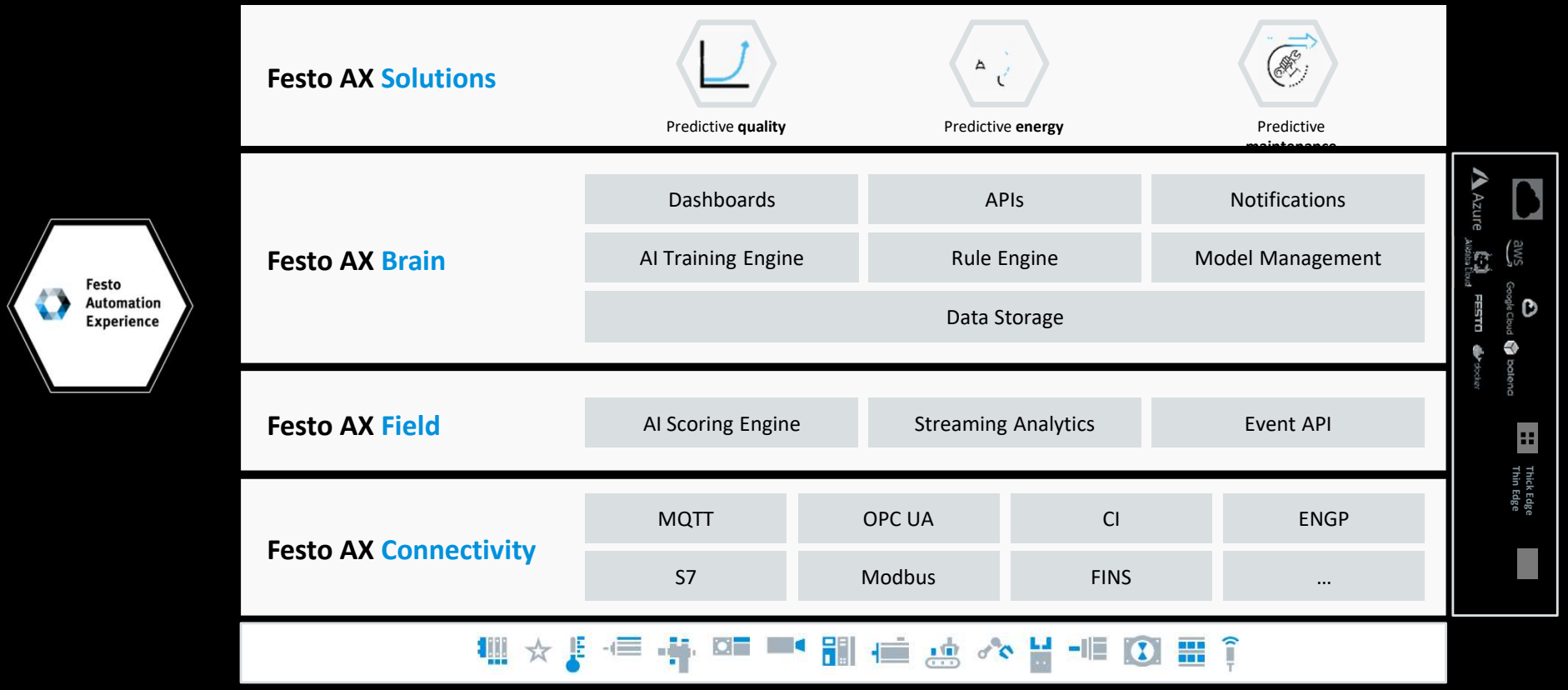
Discussion over buzzwords: “What you do it not real AI”

Start to big: “Fully connected and intelligent value chain”

Why Festo?

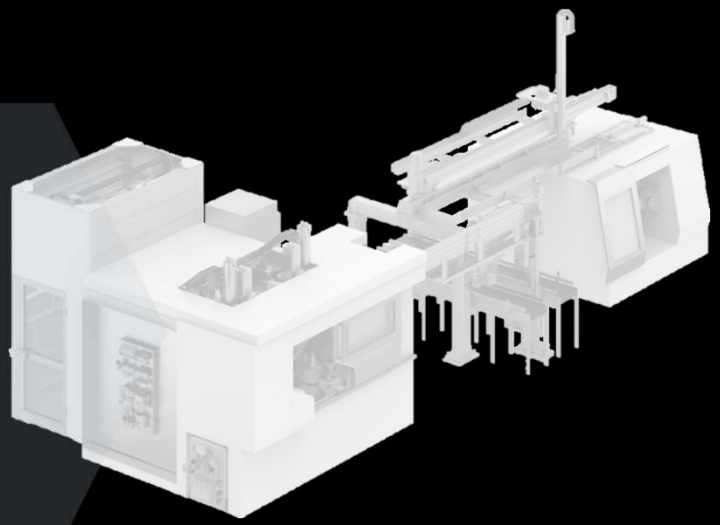

Smart components
IT & OT Connectivity
Pneumatic and Electric automation Know-How
Automation Technology
Advanced Analytics & AI
Domain Expertise
Machine Learning
Edge Computing
Data Science
Deep learning
Cloud Computing
Solutions
Technical competence
Broad client base
Worldwide network
Experience
Domain Knowledge
Trust
Festo AX
Solutions for improving OEE
Increase Productivity
Reduce Maintenance Costs
Improve Quality
Reduce Energy Consumption

Overview - Festo AX Architecture



We take seamless connectivity seriously

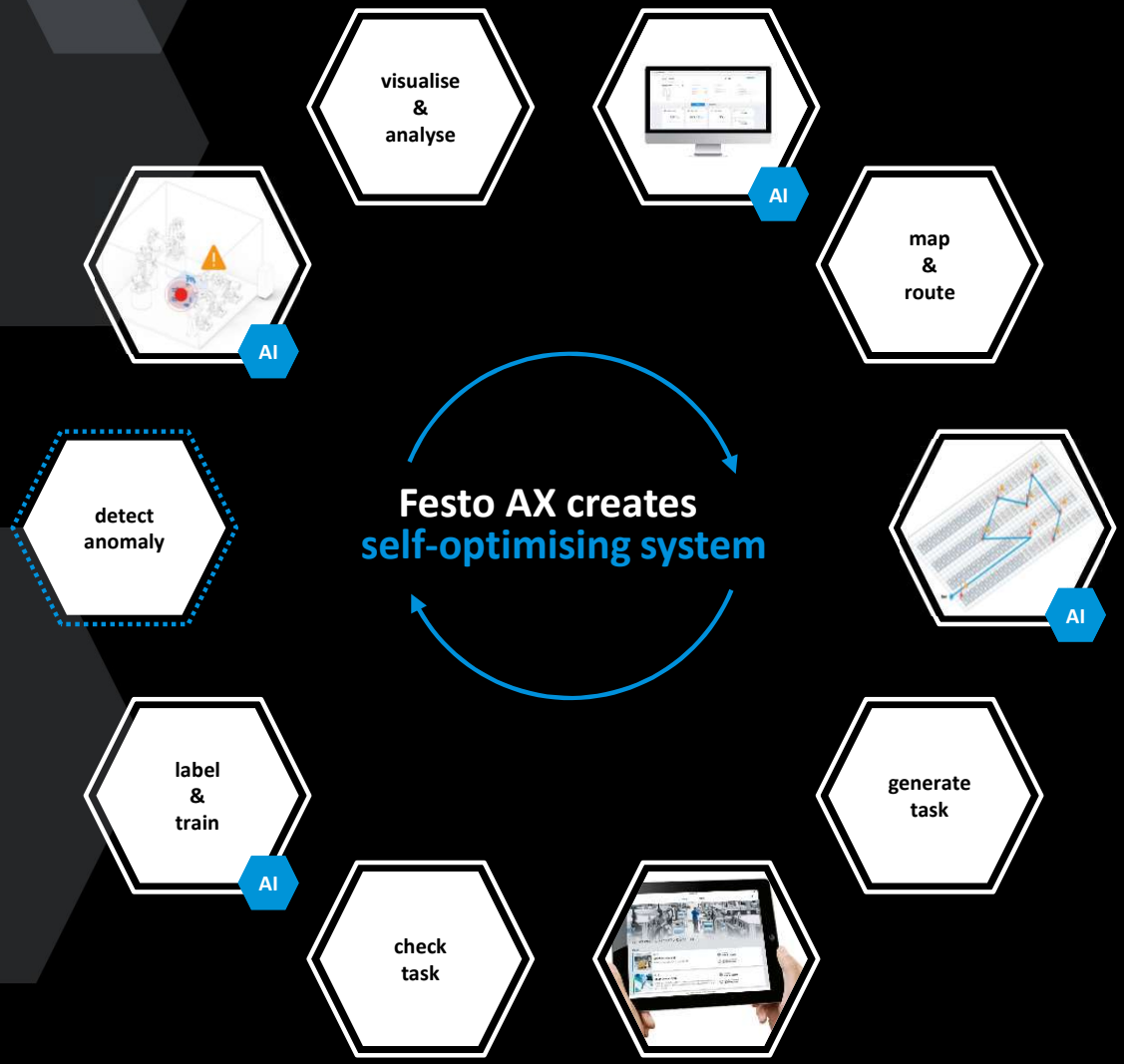
We don‘t debate a control architecture – we connect it.



SIEMENS
Rockwell Automation
BECKHOFF
OMRON
MITSUBISHI ELECTRIC
rexroth
A Bosch Company
Schneider Electric

Festo Automation Experience

- ✓Festo AX is independent of your control architecture
- ✓Festo AX works with all major control architectures
- ✓We connect Festo assets - as well as assets from other vendors!



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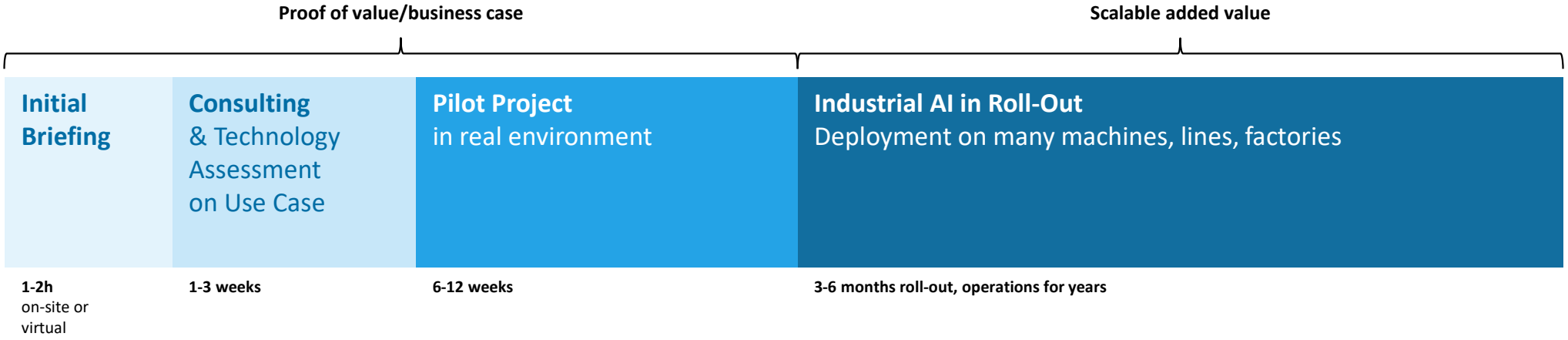
Creating a self-optimising system

- Detect anomaly – a deviation from the learned pattern, which is detected by using AI
- Visualise, analyse & classify the anomaly
- Show exactly where the anomaly occurred in the asset management overview
- Trigger a maintenance order or create a task
- Install e.g. a new component and give AI feedback
- Confirm troubleshooting → AI model is updated again

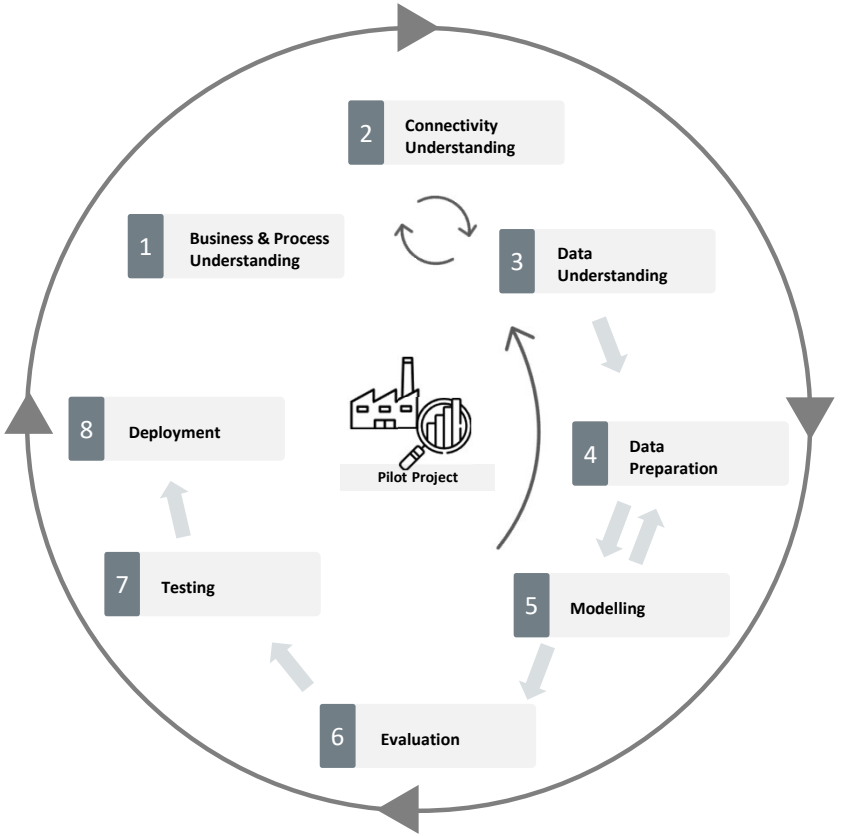
Proven results in weeks, not years



First step : Pilot projects (Proof of Concept)

Clear defined process to ensure transparency (adapted “CRISP-DM” model*)

- Festo AX as an “End to End solution”
- “Early dive in” to evaluate prediction models (from OT to IT)
- Defined Workflow
- Including domain knowledge (Human in the loop)
- Data Scientists as a Service (DSaaS)
- Documentation

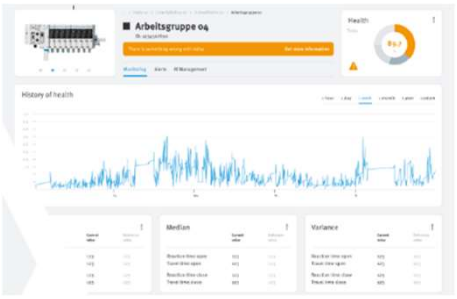


* “Cross Industry Standard Process for Data Mining”

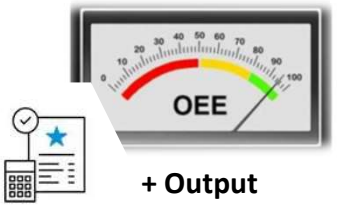
From Challenge to Ongoing Value

The challenge defines the use case, the use case must become a business case for the customer!

Challenge



Use Case



+ Output
- Maintenance
- Reject Parts
- Energy

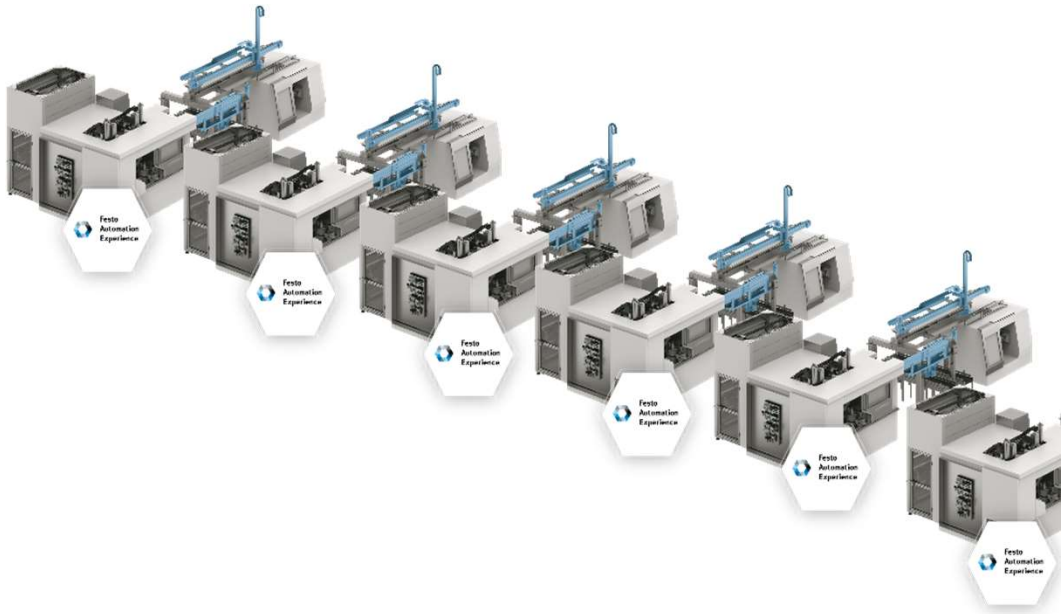
Business Case

2nd step: Rollout

Delivering value at scale

- Festo AX as an “End to End solution”
- Roll-Out to many machines, lines, factories
- Can be different IT scenario than PoC (e.g. running in customer cloud
- Integration into customer’s preferred environment, cloud, on-prem or edge

- Business Model: License-Based
- License Details to be negotiated and depending on the use case



Business value of Festo AX

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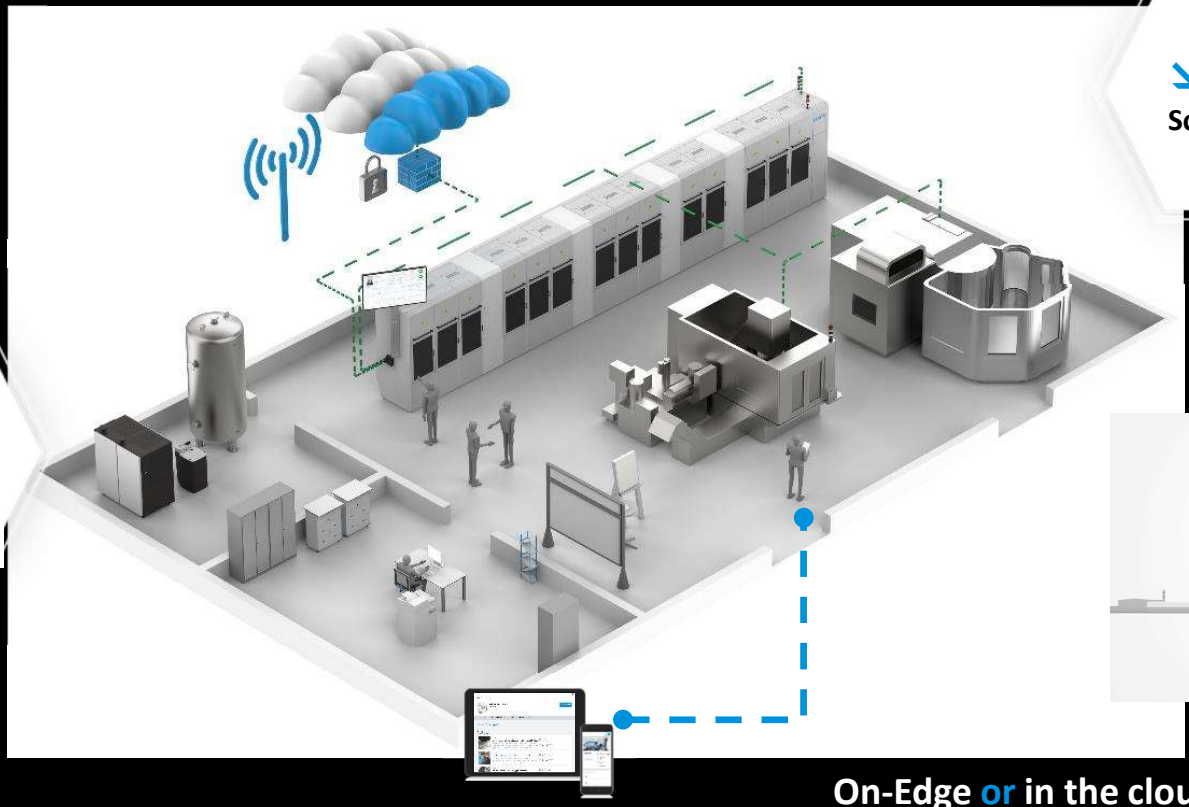
100 %
Transparenc

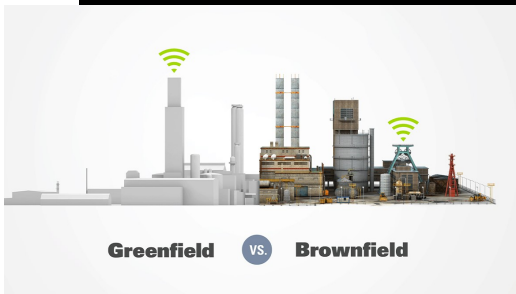
↗ +25 %
Availability

-50 % ↘
less reclamatio



↘ -45 %
Scrap costs

↘ -20 %
Unplanne
d
downtime



On-Edge or in the cloud – to your needs

Business Models for OEMs

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01100001 01101001 00001010
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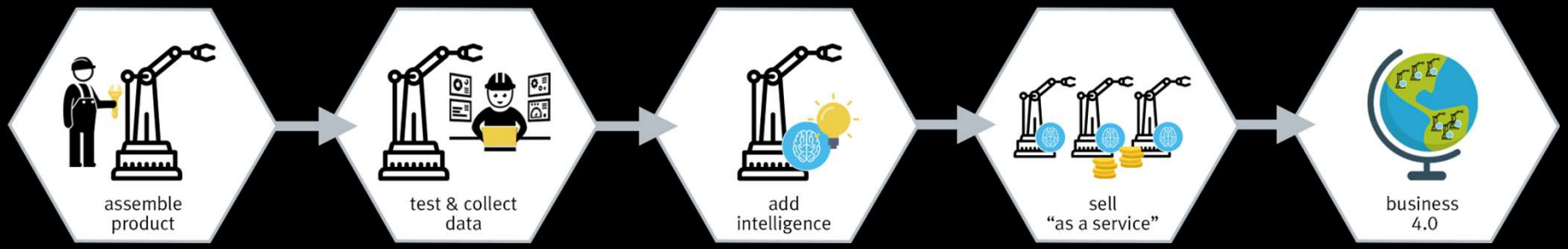
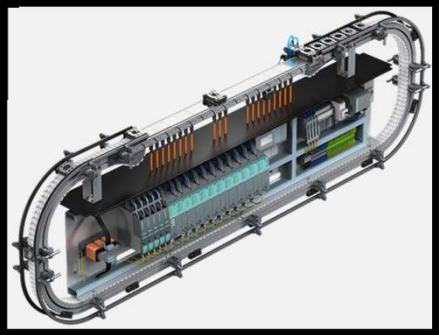
Festo AX

лв CHF Kč kr € £ kn ft zł ₽ lei ₺
د.إ R$ ৳ ¥ /元 HK$ ₹ ¥ RM Rs ฿
$ Ksh .د.م R $ € £ ¥ CHF kr € د.إ



Business Models for OEMs

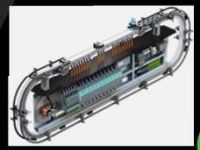
Drinking carton stacking

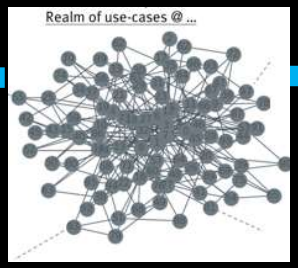


All factories in the supply chain

Use case 2: The prototype runs at 8 batches/minute, this needs to be 12

50% Increase in OEE



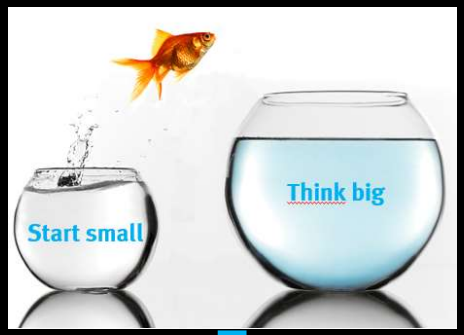


Use case 1: The current process needs to become more efficient

40% Less pallet space used

Business Models for OEMs

Nitrogen control



All factories in the supply chain

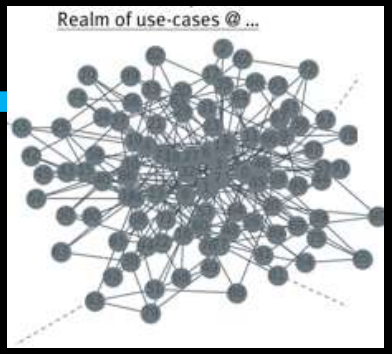
Chip industry

TSMC to invest $100 billion over 3 years to meet chip demand

Intel Invests 50 Billion USD on New Chip Factories in Arizona

Samsung sets sights on nearly $200 billion expansion in Austin area

EU outlines €43 billion plan to fix Europe's chip shortage

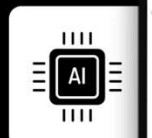


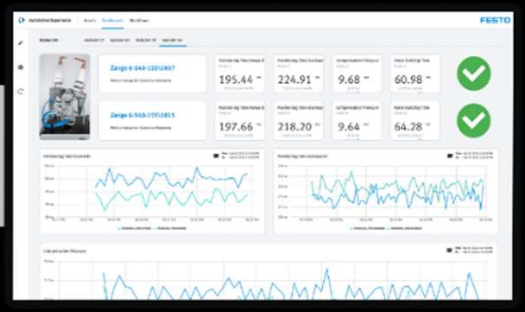
Use case 2: Optimize nitrogen usage in the system

67%
Less nitrogen

Minimizing energy consumption using AI and Machine learning

Final Assembly lines

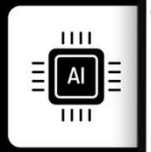


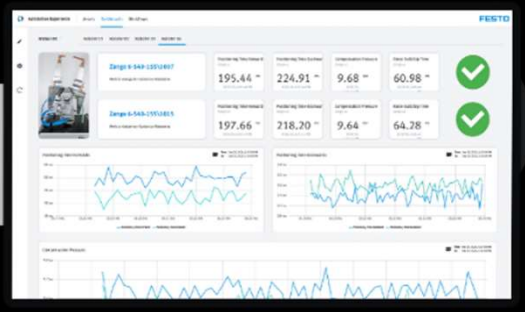


65%

Less leakages

Deburring machines





30%

Less energy consumption

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Success Story: Predictive Maintenance in Automotive

Challenge

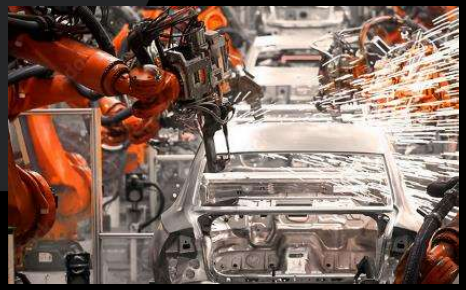
- Premium segment car production with about 1.000 cars being produced per day in one facility
- Welding Process is core process in body-in-white
- Failure of welding guns leads to costly unplanned downtime and less produced cars

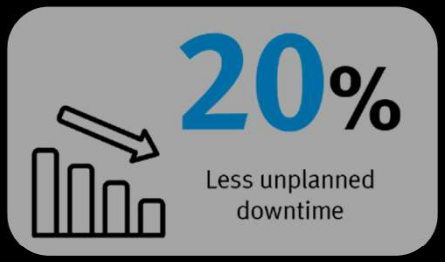
Solution

- Continuous Monitoring of welding gun (actuation and other parameters)
- Early detection of anomalies with a trained AI model and notifications to maintenance
- Integration of shopfloor data with local data acquisition and aggregation solution (Gateway)
- Deployment in cloud to ensure holistic overview over many facilities

Results

- Easy to use visualization with dashboards leads to high transparency
- Asset Management of all installed guns
- Decrease of unplanned downtime by 20%





“A comprehensive solution to optimize maintenance processes and with that, improve OEE”

FESTO

Success Story: Predictive Maintenance for Machine Tools OEM

Challenge

- Heavy use of machine tools in production of automation equipment
- Machine tool working with plastics and aluminium with lots dirt, metal shavings, etc.
- Tool Plate is moved by pneumatic cylinder
  - Wear-Out due to lots of dust etc.
  - Is cleaned regularly but still unplanned downtimes occur through this

Solution

- Continuous Monitoring of pneumatic actuator that moves the tool plate
- Data acquisition through PLC with very low intervention
- No additional sensors needed, only existing limit switches on cylinder
- Early detection of anomalies with a trained AI model and notifications to maintenance
- Analytics and Visualization next to machine “on edge”

Results

- Early warnings about pneumatic cylinder failure leads to planned maintenance and avoided downtime
- This makes machine much more productive and overall savings of 15000 EUR per year are realized

15k€

savings on one machine

„What seems like a trivial use case first evolves into a high savings potential being realized.”

Success Story: Predictive Maintenance for Packaging Machine OEM

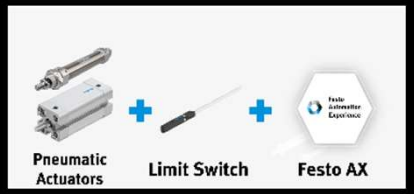
Challenge

- Packaging machines consist of many actuators moving in short cycle times
- High number of actuators also complicates failure finding down to single component

- Differentiation of machine builders extends from core process also to after sales services –and digitalization definitely plays a part in that

Solution

- Continuous Monitoring of all pneumatic actuators (Festo and other vendors)
- Data acquisition through PLC with very low intervention, no additional sensors needed, only existing limit switches on cylinder
- Early detection of anomalies with a trained AI model and notifications to machine HMI
- Analytics and Visualization next to machine on an IPC “on edge”
- Tight integration into customer’s IoT system



Results

- Early detection of anomalies to cylinders due to leakages, friction and other failure sources
- Easy localization of failures leads to more targeted maintenance
- Tight integration into HMI of machine leads to high acceptance of machine operators
- New added value offering for OEM to differentiate machine with very low initial invest

„The prediction of failures of pneumatic cylinders enhances our digital portfolio next to other automation technology involved.”

FESTO

Success Story: Predictive Quality for Wafer Sawing Machine OEM

Challenge

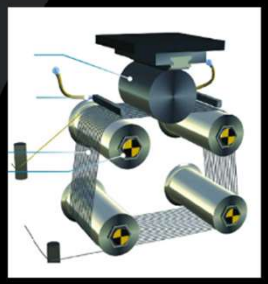
- Wafers are sawed from silicon cylinders in a process that takes 8+ hours
- Poor cuts have tremendous impact on quality and lead to high rejection rates
- Quality checks are done with random samples
- Improvements in sample selection required

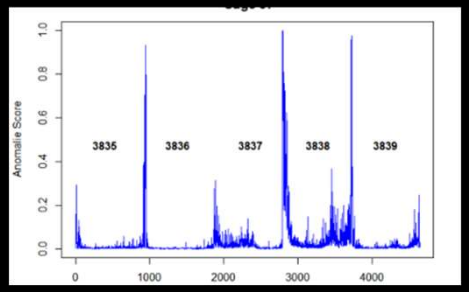
Solution

- Training of an AI model based on several data
  - Sensor data of sawing process
  - Cutting data (40+ parameters)
  - Environmental data (humidity etc.)
  - Geometrical data of wafer
- Trained model used for Anomaly Detection in sawing process

Results

- Early detection of defects in wafer production
- Better accuracy for QA sample selection
- More defect true positives during quality observations
- Fast ROI of few months, with savings of up to 100.000 € per year

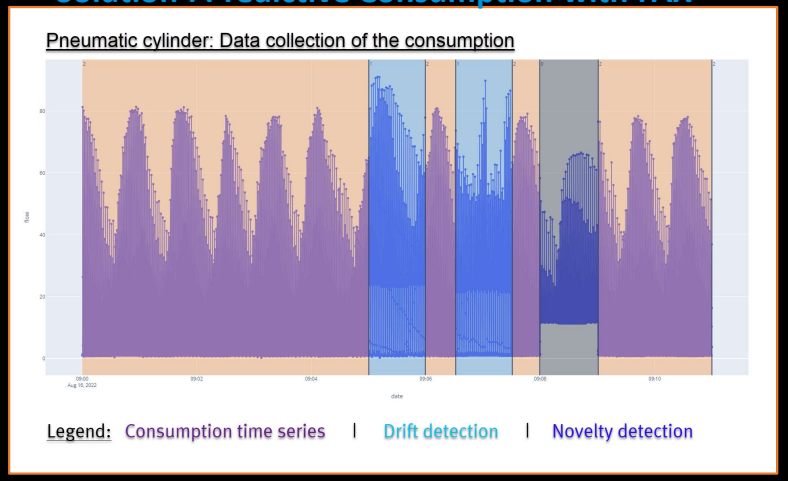




“Early detection of defects is crucial in wafer production, given the price of the resources and the cost of late defect detection.”

Example : Increase exploitation of energy-saving potential

- Data collection from installed hardware
- Analyze patterns in the consumption time series (AI)
- Drift detection (Analyze whether a trend is discernible in the patterns)
- Novelty detection (Analyze whether unknown pattern)
- Visualize the data on a dashboard
- **Solution : Predictive Consumption with FAX**



Related companies to this use case:

- Any company that have a high consumption (pneumatic, electric,…)

FESTO

Energy-Efficiency Module

Real-time data directly from machine level

IoT Gateway

Connection to the Cloud

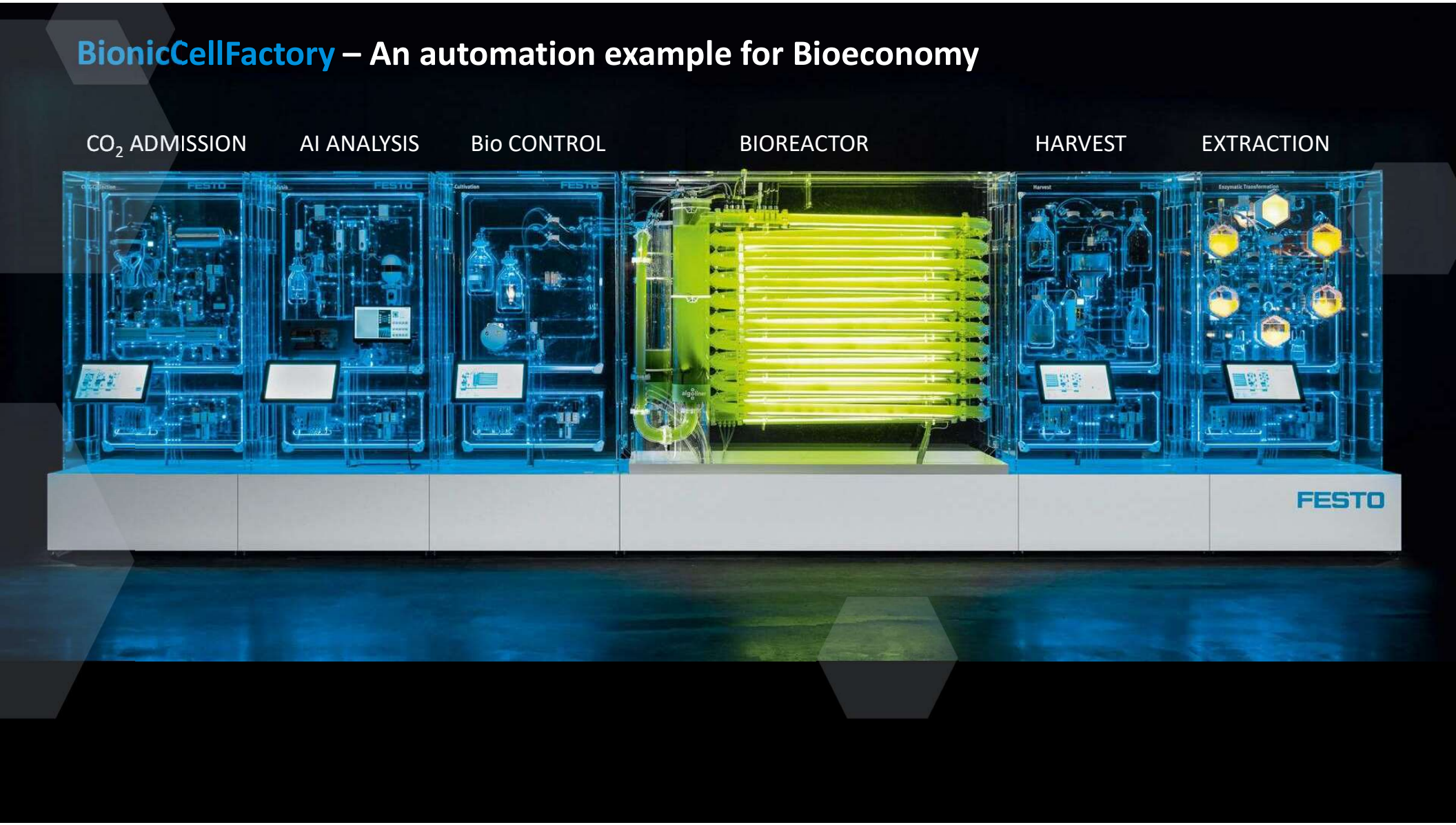
Individually configurable products

Festo Motion Terminal

App-controlled automation platform

Integration in Software Platform Festo AX

BionicCellFactory – An automation example for Bioeconomy



BionicCellFactory – An automation example for Bioeconomy

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Thank you

FME PLATFORM AI FOR INDUSTRY

BEDANKT VOOR JE AANDACHT!

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Bedankt voor je aandacht!

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