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30 May 2023

3:00 pm – 4:00 pm | BST, London
4:00 pm – 5:00 pm | CEST, Berlin, Paris
10:00 am – 11:00 am | EDT, New York City



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webinars

The importance of manufacturing execution systems in the growing PV industry



Robin Schubert
Product Manager
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Frank Tannhäuser
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Kontron AIS

Welcome!

Do you have any questions? ? 

Send them in via the Q&A tab.  We aim to answer as many as we can today!

You can also let us know of any tech problems there.

We are recording this webinar today. 

We'll let you know by email where to find it and the slide deck, so you can re-watch it at your convenience.  



Kontron AIS GmbH

The importance of manufacturing execution systems in the growing PV industry

Secure quality.

Improve processes.

Save costs.



Robin Schubert
Product Manager
Factory Automation
Kontron AIS GmbH



Frank Tannhäuser
Senior Sales Manager
Factory Automation
Kontron AIS GmbH

Agenda

- 01 PV customers of Kontron AIS
- 02 Value of data and software today
- 03 PV Trends and their significance for software
- 04 MES functions that are needed today
- 05 A look at MES practice

Portrait

Provider
for industrial
software

7

Products



ToolCommander®



EquipmentCloud®



FabLink®



FabEagle®Connect



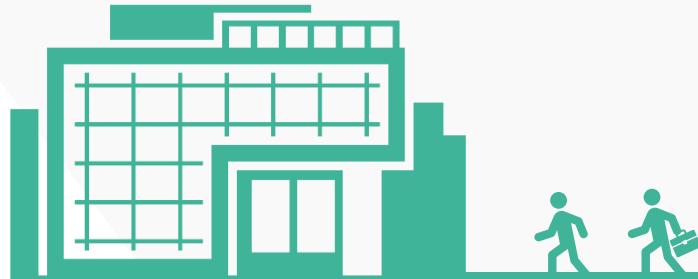
FabEagle®Monitoring



FabEagle®MES



FabEagle®LC



> 30
years of experience

> 200
employees

18,1 mio.
€ turnover



> 200
customers
in 2022

45
countries

Kontron AIS – PV and Solar Customers

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FabEagle®MES



Crystallization
Growing
Wafering

10 x

Thin film
production

14 x

Silicon based cell
manufacturing

50 x

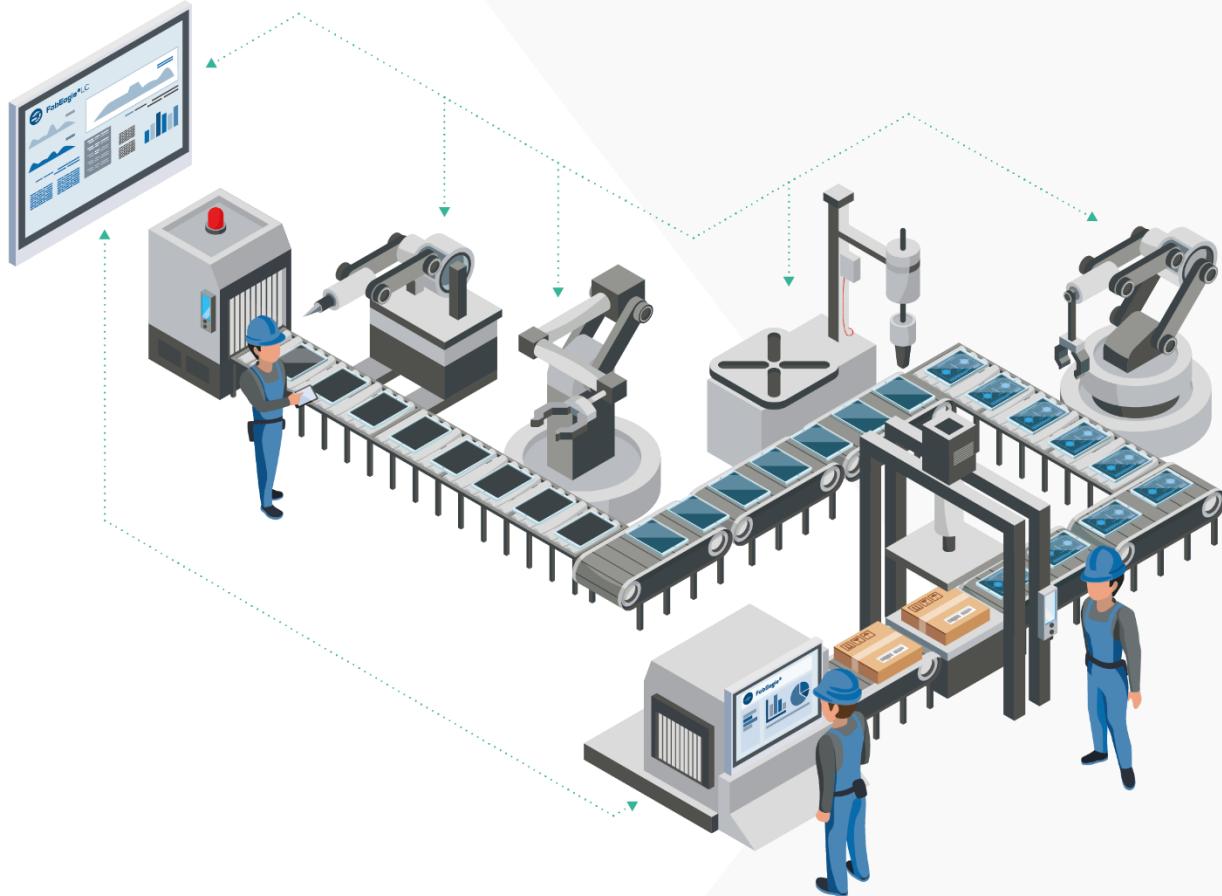
PV module
manufacturing

20 x

Solar receiver
production

2 x

Value of data and software today



- › Big data sets enable detecting small process dependencies
- › Data analysis improve quality and throughput
- › Identify maintenance needs early to avoid downtime
- › Personalised visualization of equipment data for improved workflow

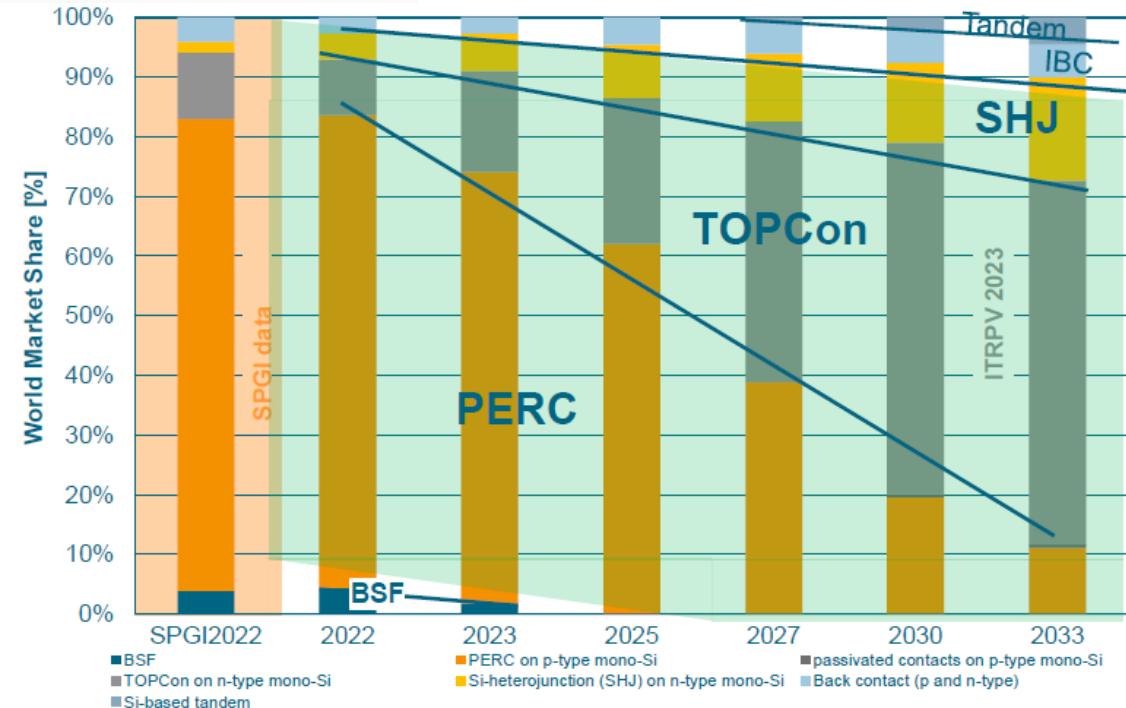
PV trends and their significance for software

1. Factor production complexity

- › Increasing complexity causes extensive data sets which need to be analyzed
- › More inline equipment is used to test quality
- › New advanced equipment provides high data output with high resolution

Cell products: cell technologies

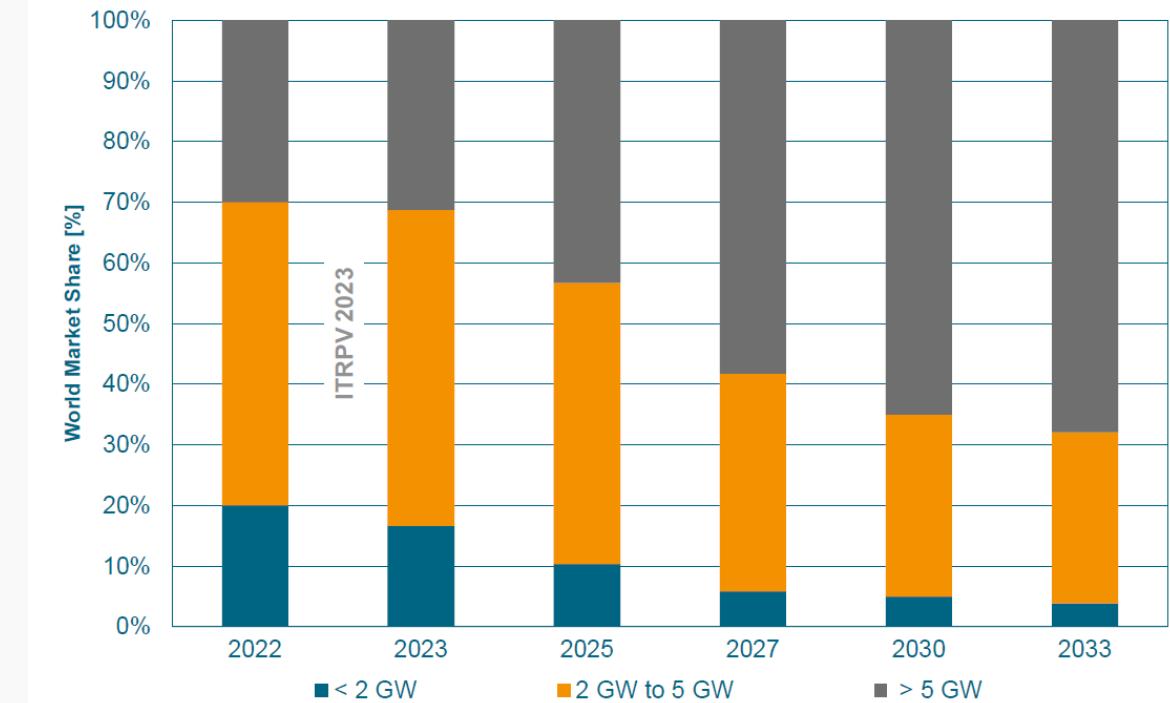
(Source: VDMA, ITRPV 2023)



2. Factor production capacity

- › Data volumes increase proportionally to production volumes
- › With higher throughput per factory, the risks increase (e.g., cost of downtime)
- › Requirement for comparability between several company locations

Trend for production sites capacity (Source: VDMA, ITRPV 2023)



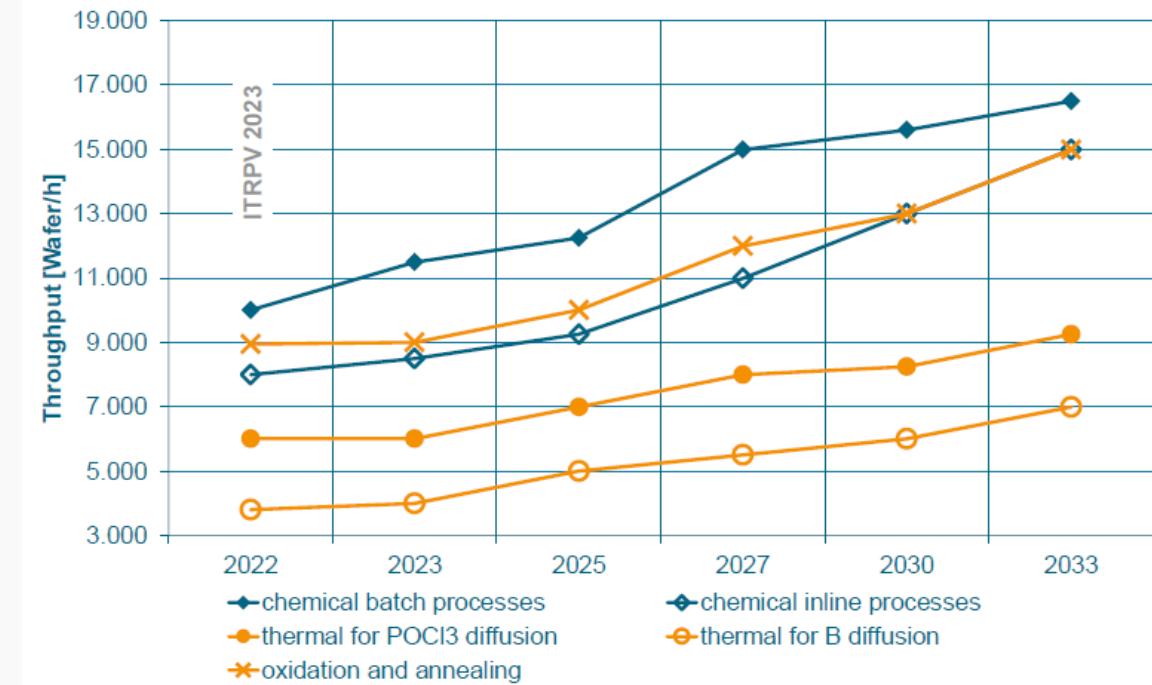
PV trends and their significance for software

3. Factor maintenance and uptime

- › High-cost pressure requires preparation of planned and unplanned downtime
- › Information on handling complex equipment must be available immediately
- › Support through digital documentation of equipment data and maintenance to optimize service calls

Cell products: cell production tool throughputs

(Source: VDMA, ITRPV 2023)





FabEagle®MES

Components and features



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MES functions that are needed today

Solution



Increased transparency

- › Online Process Visualization
- › Manufacturing Visualization
- › Trends / Reporting
- › Logbook / Machine Log



Traceability

- › Material and Carrier Tracking & Interlock
- › Inspection and Rework
- › Quality Data Acquisition
- › Long-term Archiving

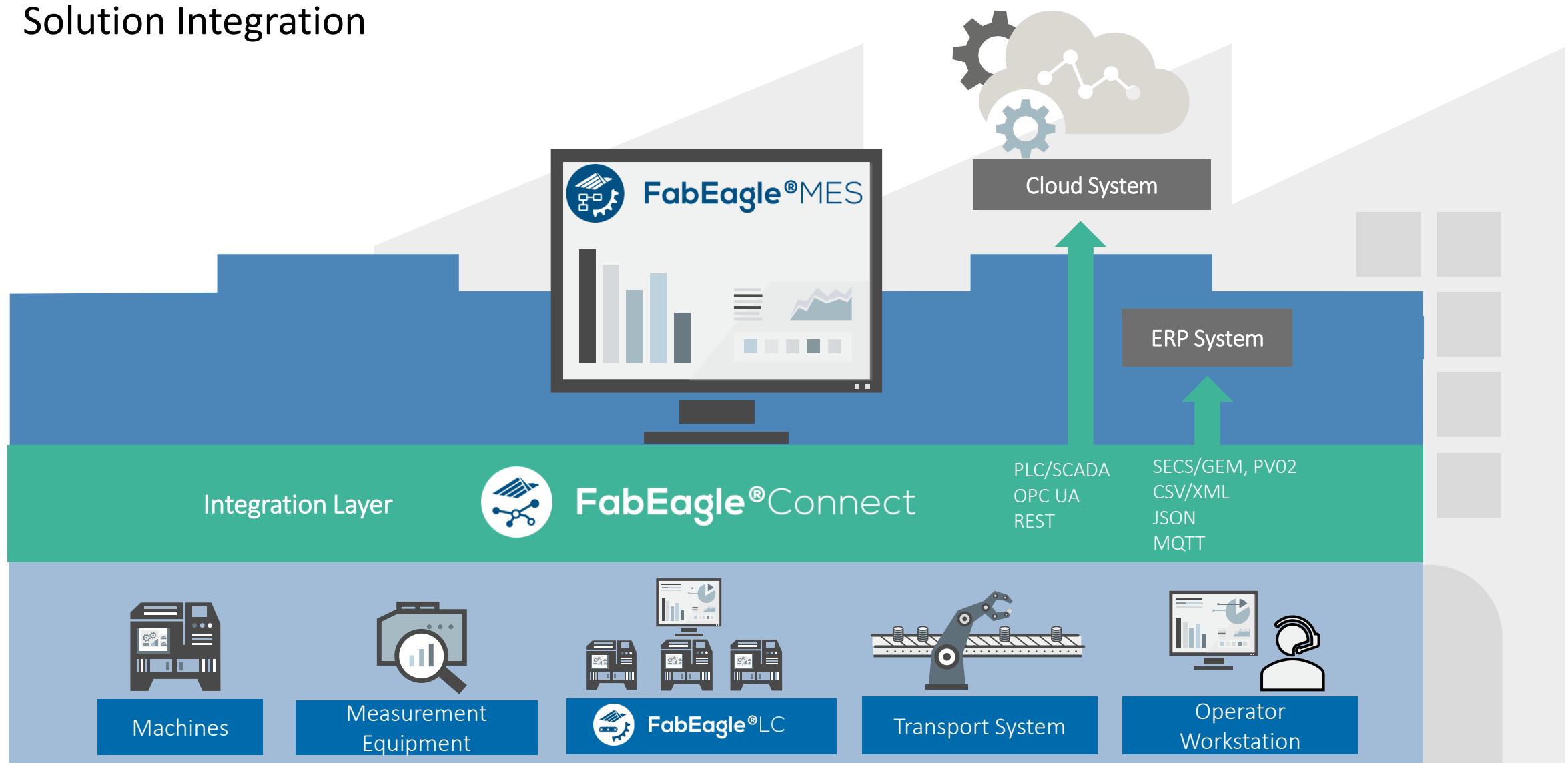


Production control

- › Order Management
- › Workflow Management
- › Maintenance Management
- › Online-SPC
- › Event Manager

MES functions that are needed today

Solution Integration



MES functions that are needed today

Modules



Production
Visualization



Order Management



Work Plans



Recipe Management



Production
Control



Material Tracking



Machine and Production
Data Acquisition



Product Data
Acquisition



Reporting &
Online SPC



Archiving



Operator
Workstation



User Management



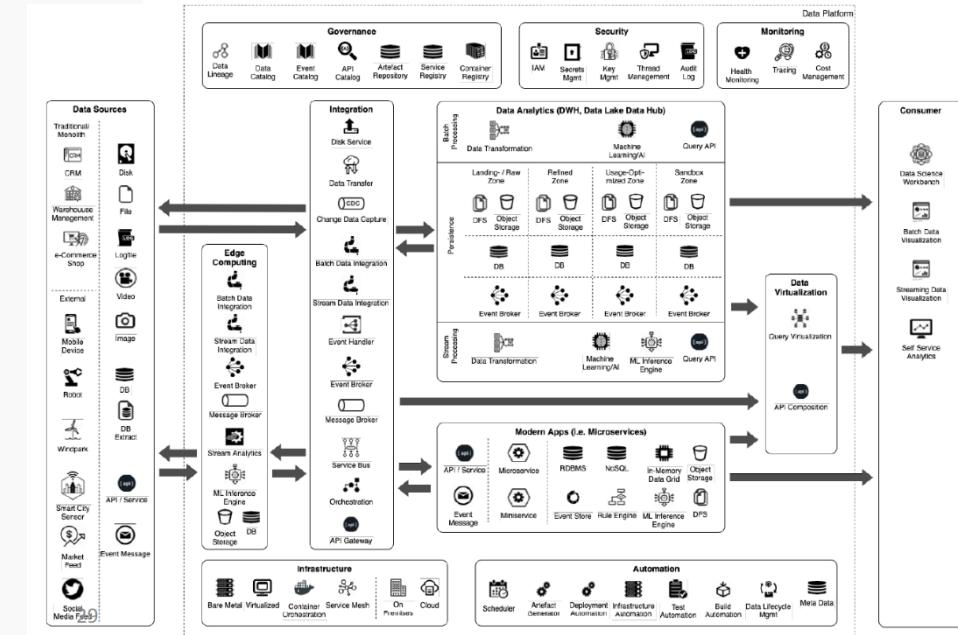
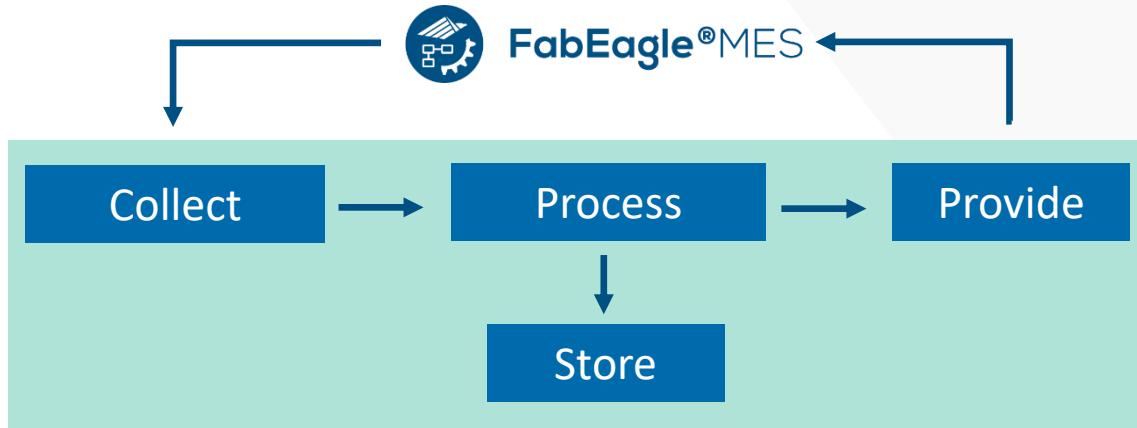
MES functions that are needed today

Blueprint for modern data architecture

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- › Event based
- › Separation of storage and compute
- › Automation over manual coding and processes
- › Keep raw data in central place with potential storage tiering

Hybrid solution of MES and Cloud



 **EquipmentCloud®**

MES functions that are needed today

Cloud-enabled MES extensions

The screenshot displays the EquipmentCloud® Portal interface, featuring a central dashboard and several side modules. The main dashboard includes a 'Top Alarms - 7 days' bar chart, an 'Equipment States - Engi...' card, a 'KPI Trend - Technical Availability - Last 7 days' line chart, a 'Maintenance Calendar - EQ001' for October 2021, a 'Service Requests / Calls - EQ001' list, 'Latest Journal Entries - 4 weeks' for EQ001, and a 'Workflow Dates' section for the 'DemoTool Plan'. A 'Factory View - World' map is also present. The side modules include 'Link List' (History), 'My OpenIssues' (0), 'I'm Responsible' (0), 'Recent OpenIssues' (7), and a summary of 15400 units.

Moduls to support production:

- › Monitoring
- › Maintenance
- › Documents
- › Open Issues
- › Knowledge Base
- › Spare Parts
- › Remote Assistance

MES functions that are needed today

Cloud-based maintenance management

The screenshot shows the 'Maintenance' software interface. On the left is a navigation sidebar with options: Home, Overview, Manage Maintenance, Manage Checklists, Archive, and History. The main area is titled 'Maintenance for EQ001' and displays a calendar for May 2022. The calendar grid shows various maintenance tasks for equipment EQ001, each with a small icon and a description. For example, on May 1st, there is a 'EQ001 - #451 Regular Maintenance (finished)' task. On May 15th, there is a 'EQ001 - #2851 Module Maintenance (announced since 1h 36min)' task. On the right side of the interface, there is a 'Equipment Hierarchy' tree view. The tree starts with 'Tests', then 'World' (which is expanded to show 'Austria', 'Bolivia', 'China', and 'HanSen Electronics Ltd.'), and finally 'EQ001' (which is expanded to show 'EQ010' and 'EQ424').



Functions:

- › Maintenance calendar
- › Cyclic, alarm or condition-based, Process value-based
- › Incremental counter maintenance
- › Integrated workflows with variable parameters

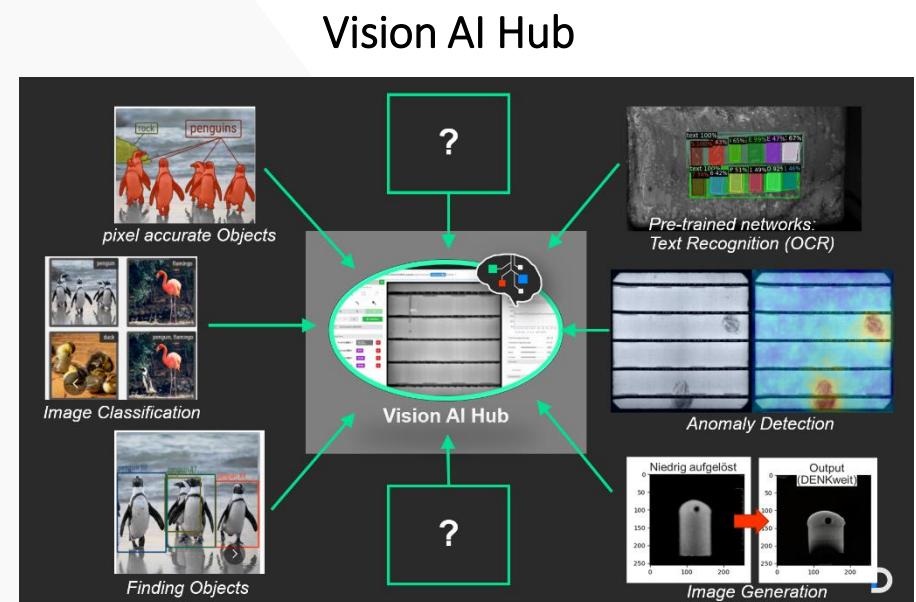
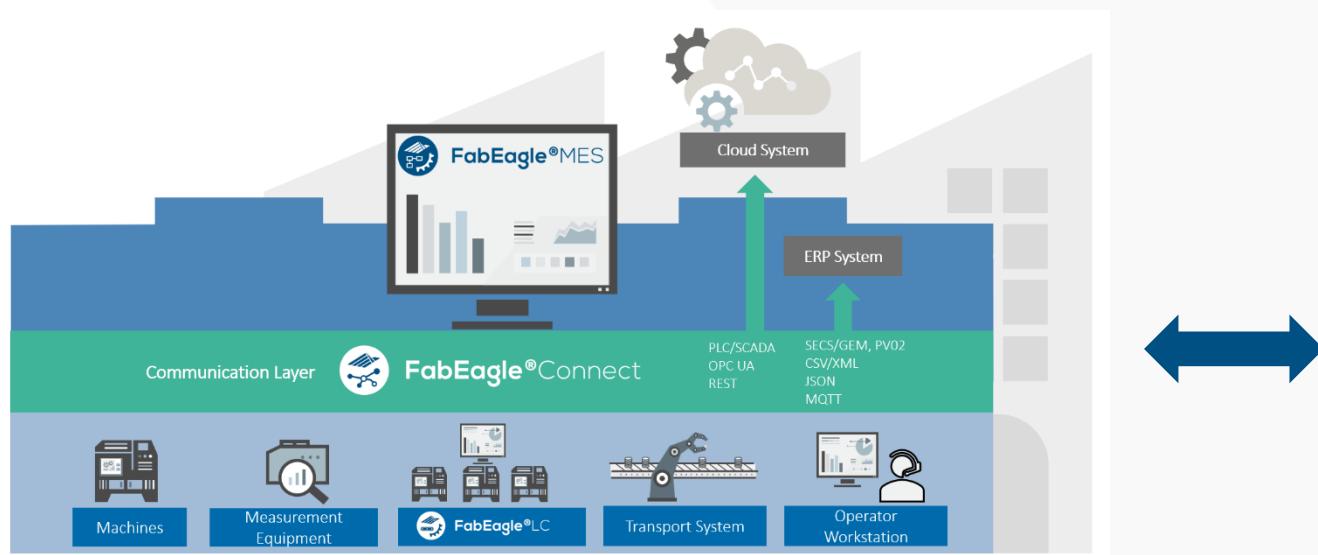
Your benefit:

- › Planning, documentation (link to workflows) and reminder in one tool

MES functions that are needed today

Integration of Vision AI Hub

- › Image processing can be used as virtual (software) measurement device
- › Common data handling for process control and reporting within MES



MES functions that are needed today

Connectivity overview



HMI & SCADA



Big Data
Analytics



MES & ERP
FabEagle®MES



Database



Historian
Archiving

OPC UA

REST

TCP/IP

Custom Client

MQTT



FabEagle®Connect

OPC UA

PLC-S7

TCP/IP

PV02

SECS/GEM

XML/JSON



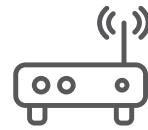
OPC Server



PLC



Application
Database



Sensors &
Devices



Files



FabEagle®MES

A look at MES practice



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A look at MES practice

Webclient – Factory visualization

The screenshot shows the FabEagle®MES Office Workstation interface. The top navigation bar includes 'Fab Overview', 'Material', 'Orders', 'Reports', 'Messages', 'Master data', 'SPC', 'Dashboard', 'Violations', and 'Monitor'. The main area displays a factory floor layout with various processing units: PAC1, PAC2, PRN1, PRN2, PSG1, DIF 1.3, DIF 1.2, DIF 1.1, CVD1, and COM1, COM2. Below the layout is a table for 'Schichtinformation' (updated 14:25) showing current and target values for Ziel, Klasse, A, B, C, and Schrott. A trend table shows data for three shifts. The bottom section displays a bar chart for 'Produzierte Module der letzten Stunden' (produced modules in the last hour) with categories Ziel, A, B, C, and Schrott.

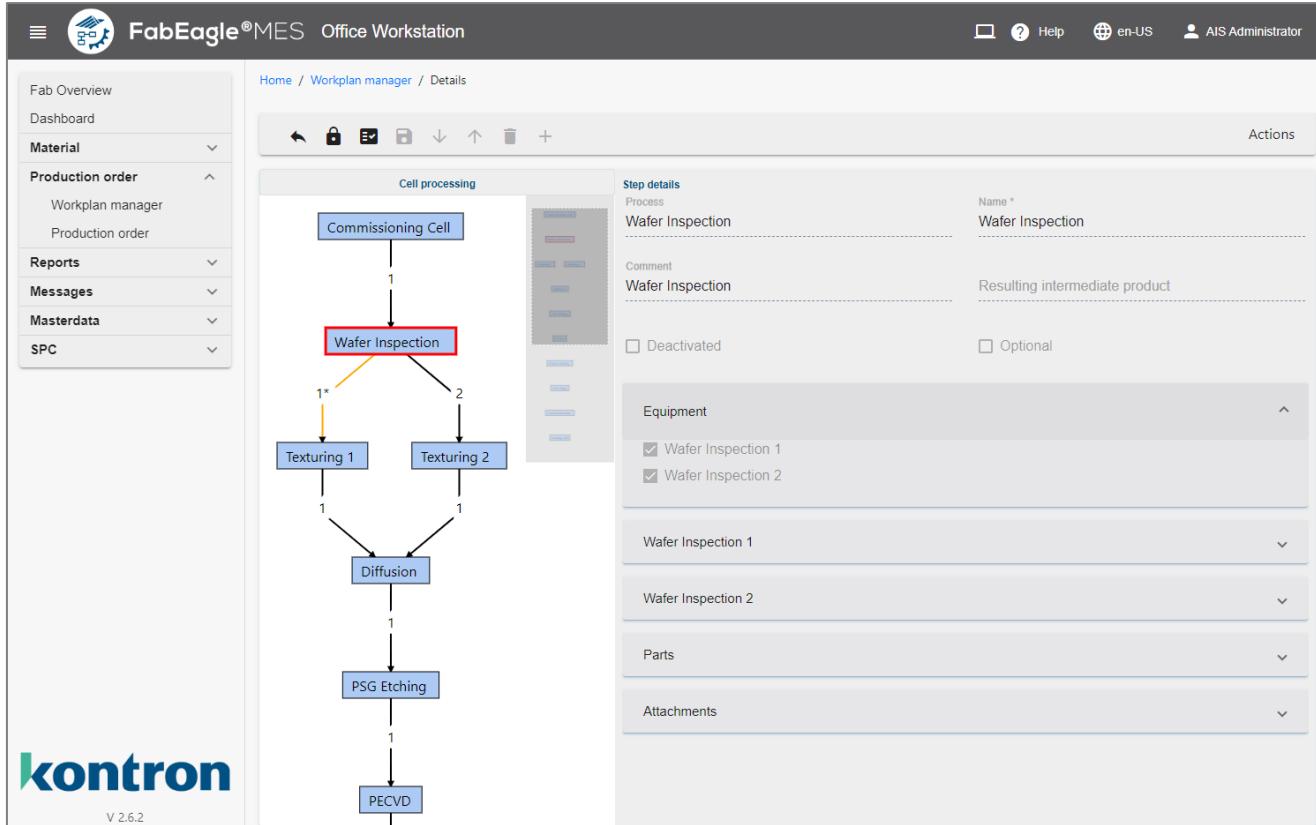
Aktuelle Schicht					
Ziel	235	Klasse	A	B	C
Aktuell	1	Menge	1	0	0
Trend	19	[%]	100.00	0.00	0.00
Schicht	Beginn	Ende	Aktuell	Ziel	
3Schicht-Spätschicht	18.8.2022 14:00	18.8.2022 22:00	1	235	
3Schicht-Frühschicht	18.8.2022 6:00	18.8.2022 14:00	158	235	
3Schicht-Nachtschicht	17.8.2022 22:00	18.8.2022 6:00	147	235	

Module	Ziel	A	B	C	Schrott
03:00	30	25	0	0	0
04:00	28	22	0	0	0
05:00	10	10	0	0	0
06:00	32	32	0	0	0
07:00	18	18	0	0	0
08:00	18	18	0	0	0
09:00	18	18	0	0	0
10:00	18	18	0	0	0
11:00	12	12	0	0	0
12:00	28	28	0	0	0
13:00	10	10	0	0	0
14:00	0	0	0	0	0

- › Transparency with Equipment states (SEMI E10)
- › Monitoring with trend views and KPIs for solar cell or module production

A look at MES practice

Webclient – Workplan view



- › Configure your workflow graphically
- › Use it as a template for product variants
- › Setup bill of material (BOM) for ERP posting
- › Select recipes and equipment parameters
- › Add documents for reference or work instructions
- › Setup alternative material routes based on state or process data of material
- › Configure rework loops to route material back to previous work steps

A look at MES practice

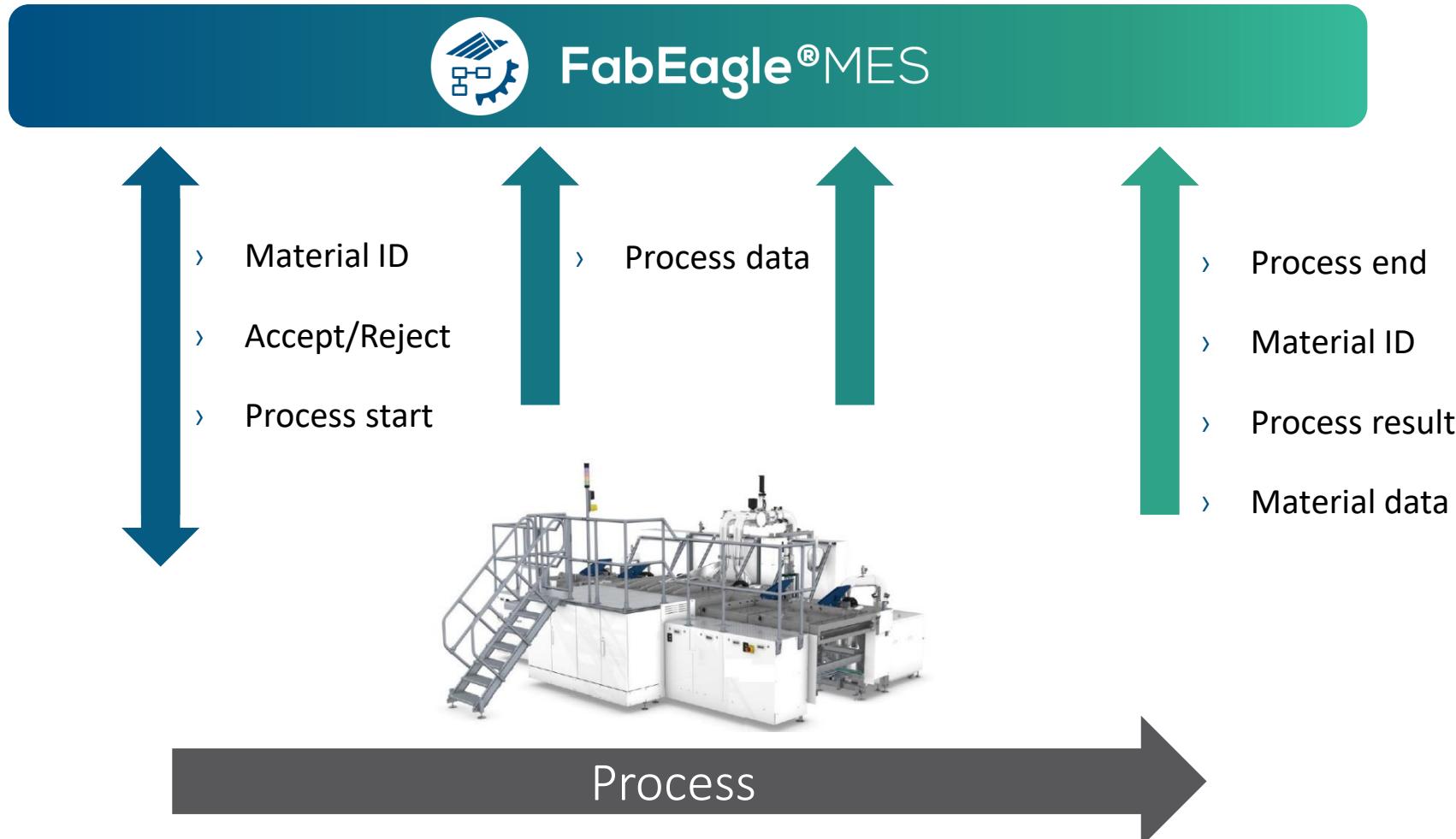
Webclient – Carriers and materials

The screenshot shows the FabEagle®MES Office Workstation interface. The left sidebar includes sections for Fab Overview, Dashboard, Material (Transport container selected), Bin, Process container, Packaging lot, Locking list, Production order, Reports, Messages, Masterdata, and SPC. The main content area shows a list of transport containers (TR025, TR024, TR023, TR022, TR021, TR019, TR018, TR017, TR016, TR015, TR013, TR012, TR011, TR010) with columns for Container, Material count, Order, Work plan, Work step, and Actions. A detailed view is shown for TR023, including Masterdata (Material 3269, Container TR023, Product number Cell.Mono.Std, Production order Cell processing, Work step PSG Etching, Slot 100, Product Cell.Mono.Std, Work plan Cell processing) and a Material history diagram. The history shows a sequence of steps: Commissioning Cell (9min, 40s), Wafer inspection (3min), Texturing, and Diffusion. The right side of the screen displays a table of measurement values for Equipment Inspection mCrack 1, including TotalQuality, TotalQuality.CellQuality, TotalQuality.CellQuality.BrightSpot, TotalQuality.CellQuality.BrightSpot.Count, TotalQuality.CellQuality.BrightSpot.MaxArea, TotalQuality.CellQuality.BrightSpot.MaxHeight, TotalQuality.CellQuality.BrightSpot.MaxWidth, TotalQuality.CellQuality.BrightSpot.TotalArea, TotalQuality.CellQuality.DarkSpot, TotalQuality.CellQuality.DarkSpot.Count, TotalQuality.CellQuality.DarkSpot.MaxArea, and TotalQuality.CellQuality.DarkSpot.MaxHeight. The data was last loaded at 5/25/2023 4:05:53 PM.

- › Filter carriers (containers)
- › Manage materials and products
- › Drilldown from Carriers to Content and Data

A look at MES practice

Communication MES – Equipment



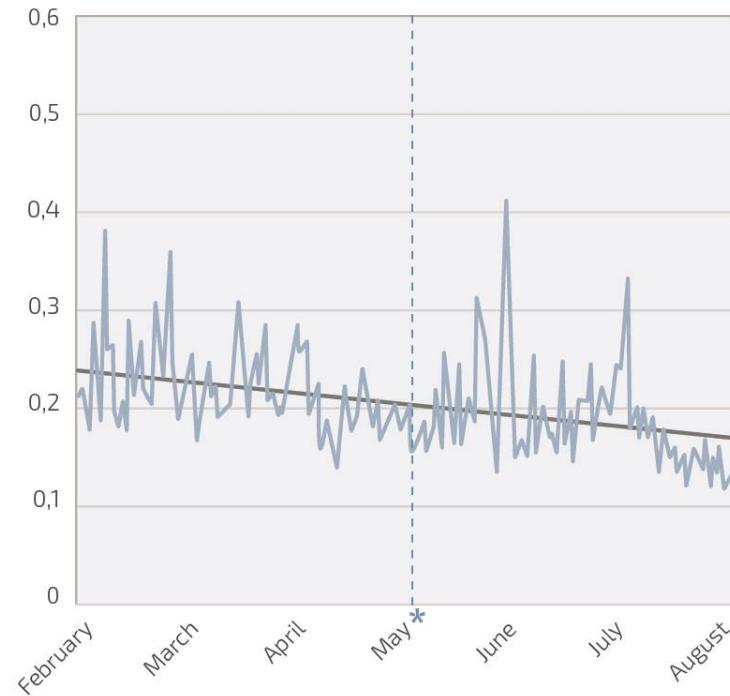
A look at MES practice

Benefits of virtual tracking in solar cell production

Material tracking and solar cell efficiency



Material tracking and standard deviation of solar cell efficiency



* Improvement of the tracking rate

■ Average cell efficiency ■ Cell tracking rate

■ Trend ■ Efficiency deviation

A look at MES practice

Solar cell and module production (sample project)

- › Over 1,000 equipment connected to FabEagle®MES to produce several 100,000 solar cells per day
- › Real-time connection to ERP to track finished and semi-finished products
- › Process and Equipment data acquisition with Online-SPC
- › Material and carrier interlock
- › Product Track & Trace
- › Monitoring of equipment performance



Crystal Growing

Cropping

Wafering

Solar Cell

Solar Module

Benefits of MES modules



Increased transparency

- › Reduce downtimes and troubleshooting to optimize production
- › Motivate employees with feedback on the production state



Traceability

- › Improving product quality by collecting material batches and process data
- › Rapid response time to deviations by automated data acquisition



Production control

- › Improving product quality by collecting material batches and process data
- › Rapid response time to deviations by automated data acquisition

Our team, your questions.



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Q&A

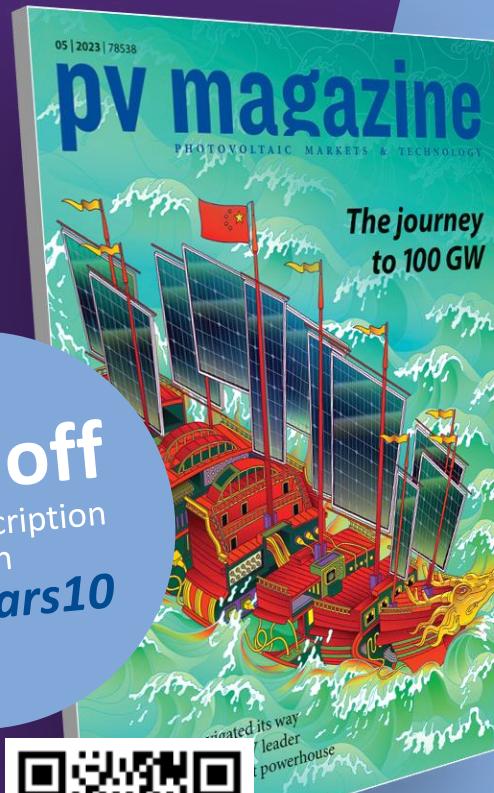


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12:00 pm – 1:00 pm CEST, Berlin, Paris, Madrid
2:00 pm – 3:00 pm Dubai

Thursday, 1 June 2023

3:00 pm – 4:00 pm BST, London
4:00 pm – 5:00 pm CEST, Berlin, Paris, Madrid

Many more to come!

The role of monitoring in managing power and maximizing returns: Indian C&I segment in focus

AI or not AI for fault prediction and climate risk assessment in solar plants: misconceptions and facts

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