

Building the Next Generation of PV Factories

The factory owner's journey

NEXUS GreenTech | Technology & Knowledge Transfer Consultants

Sebastian Nold, Co-Founder & Managing Director

PV CellTech USA 2026 | San Francisco | 14 October 2026

Who is NEXUS GreenTech?

A Spin-off from Fraunhofer ISE

60+ years

Combined experience in PV R&D at Fraunhofer ISE



**Dr.
Jochen
Rentsch**

PhD in Physics

> 200 publications on photovoltaics

Technology Transfer



**Dr.
Sebastian
Nold**

PhD in Industrial Economics

> 90 publications on photovoltaics

**Techno-Economic Analysis
and Factory Planning**



**Dr.
Nico
Wöhrle**

PhD in Physics

> 60 publications on photovoltaics

**PV Quality Assurance
and Simulation**

Strong industry network: equipment suppliers, factory planning and R&D partnerships

Who is NEXUS GreenTech?

General Scope of Services



Factory Planning

Planning, consulting, testing, assessment, and implementation of production and factory planning



Studies

Conducting feasibility studies



Business Consulting

Consulting and risk management for owners and investors



Management Support

Interim management services and organizational development support



Staffing Services

Secondment of employees to third parties

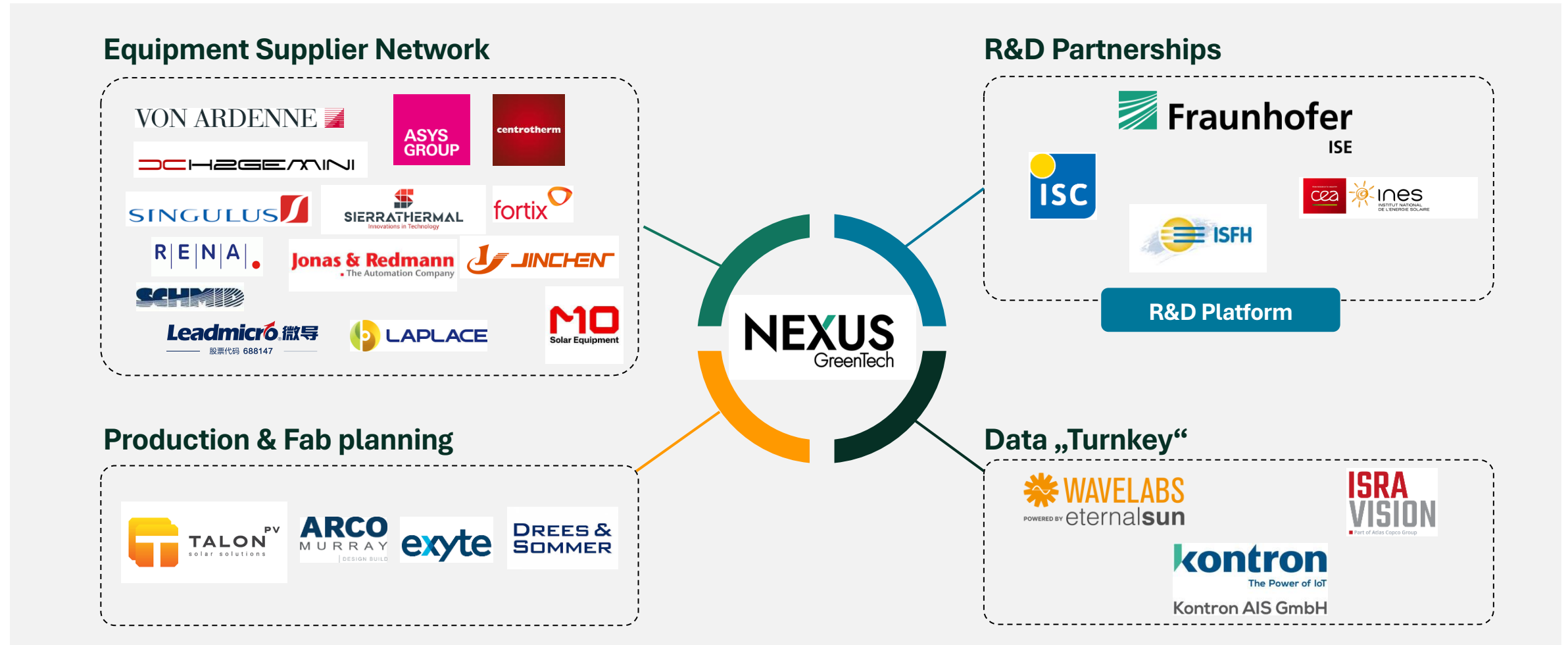


Strategic Partnerships

Engagement in strategic partnerships for a successful project execution

Backed by a Strong Network from Research and Industry

Technology & Knowledge Transfer Consultants with a Strong Industry Network



Where Do We Operate?

Current Project and Customer Landscape



-  Running
-  Contract negotiations
-  In discussion

End-to-End Technology Transfer for GreenTech

NEXUS GreenTech & Fraunhofer ISE

Who can support us as one integrated partner across the project lifecycle?



NEXUS GreenTech: Owner's Engineer & Integrator

- Project orchestration: PMO, schedule, budget, risk, suppliers & interfaces
- Turnkey-alike benefits while the client retains all direct supplier contracts

Fraunhofer ISE: Technology & Process Partner

- R&D & validation: technology/feasibility analysis, fab simulation & prototyping
- PVTEC pilot line FAT/SAT benchmarking & process-recipe transfer
- Employee training & certification

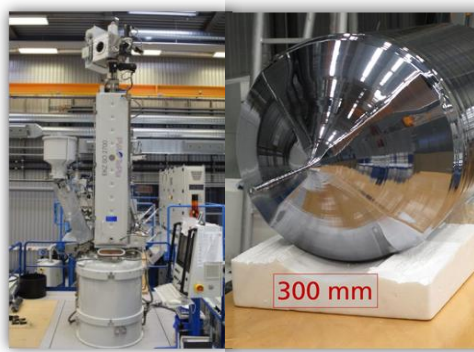
Track Record (2023–2025)

- PV manufacturing project development & support: USA, India, France & Indonesia
- Fraunhofer ISE industrial pilot lines: up to G12 wafers, cells & modules

PV-TEC Pilot Facilities @ Fraunhofer ISE

How can we evaluate processes and prepare technology transfer?

Ingot & Wafer



Solar Cells



PV Modules



PV-TEC – Industrial-scale and automated tool platform for Ingots, Wafers, Cells and Modules

- Prototyping & process validation up to G12
- FAT/SAT benchmarking on **PV-TEC** pilot lines
- Process-recipe transfer and employee training



World's Leading Accredited Laboratories

PV Pilot Facilities and Test Laboratories • Images: © Fraunhofer ISE

Pre-Feasibility & Feasibility Support

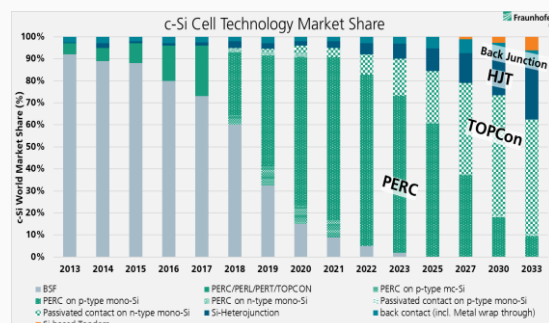
Which technology, equipment and partners fit our product, and which IP issues must we resolve?

(Pre-) Feasibility



- Market & Technology Overview
- Technical IP & Freedom-to-Operate Advisory
- Technology and Cost Assessment
- Financials & Business Plan Development
- Sustainability Analysis

Market & Technology Overview

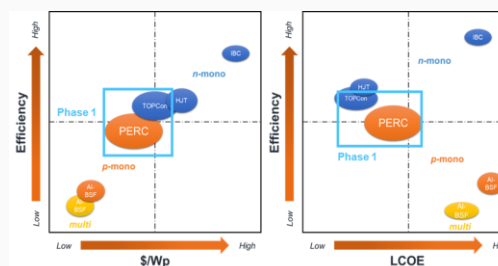
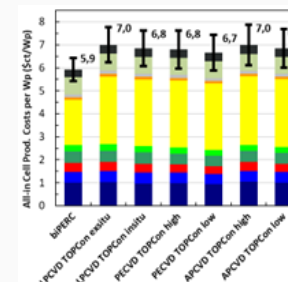


Technical IP & Freedom-to-Operate Advisory

- Patent landscape & technical claim mapping
- Technical exposure & evidence gaps
- Mitigation priorities
- Technical dossier for qualified patent counsel

Technology and Cost Assessment

- Technology route comparison
- Total cost of ownership across the PV value chain
- Technical & manufacturing risks



Financial Modelling & Business Plan Development

- Manufacturing costs & business case modelling
- Detailed CAPEX/OPEX analysis
- Financial KPIs, configurable scenarios & sensitivities
- Investor support

Sustainability Analysis

- Lifecycle & energy payback
- Socio-economic effects
- Circularity
- Resource criticality

In close cooperation with

Conceptual Design Support

Which suppliers and factory setup will deliver our target output?

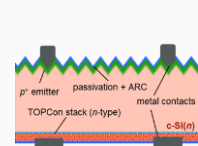
Conceptual Design



- Product, Process & Equipment Definition
- Supplier Selection & Initial Line Planning
- Initial Site, Buildings & Layout Definition

Product, Process & Equipment Definition

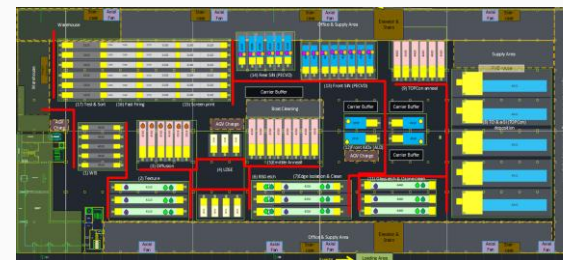
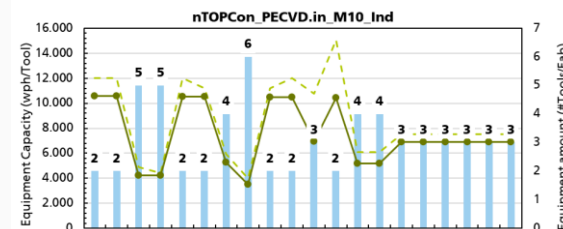
- Definition of target product
- Tool KPIs & initial BOM



Industry Std.	High ind. focus	Alternative Option
TOPCon LPCVD exsitu	TOPCon PECVD insitu	TOPCon PVD
	Cell Line Loader & WIS	
	SDE + Texture + Clean	
	Diffusion LP-BBr ₃	
	Laser Selective Emitter	
	Boron Emitter Anneal / Drive in	
	SSE of BSG + CEI + O ₂ -Clean	
LPCVD: TO + a-Si(i)	PECVD: TO + a-Si(n)	PVD: TO + a-Si(n)
Diffusion LP-POCl ₃	TOPCon: High T anneal	
PSG + SSE + BSG	SSE + BSG	
	HF - O ₂ -Clean	
	ALD Al ₂ O ₃	
	Outgassing optional, may be included in the ALD tool	
	PECVD SiN _x (front)	
	PECVD SiN _x (rear)	
SP Ag-Al grid (front) (Dual print: Finger + Floating BB)		
SP Ag grid (rear) (Dual print: Finger + Floating BB)		
FPO + (Post firing anneal / Hydrogenation / RLID)		
	Cell Tester & Sorter	

Suppliers Selection & Initial Line Planning

- RFP preparation & vendor selection
- Technology route, equipment & material supplier coordination
- Tool-utility matrix
- Line balancing & initial layout



Initial Site, Building & Facility Layout Definition

- Site requirements & master plan
- Process & material flows
- Factory/facility layout & logistics concept
- Dynamic simulation: net output, tool utilization & buffers

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Basic & Detailed Engineering Support

How do we coordinate suppliers and design an intelligent factory?

Basic Engineering



Detailed Engineering

- Line Specifications & BOM Development
- Integrated Resource-Efficient Fab Modelling
- Plant Simulation, Final Layout & Logistics Planning

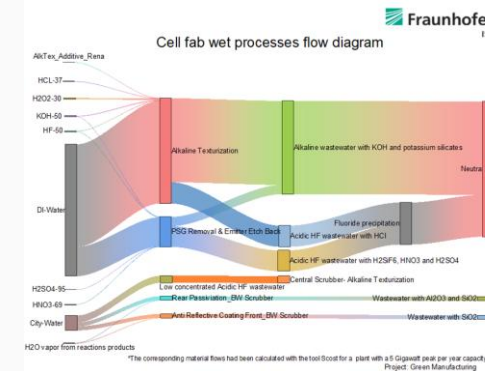
Line Specifications & BOM Development

- Process & material specs: tool/fab KPI basis
- Integrating Tool/facility utility data
- Supply chain analysis & material testing
- BOM material pre-tests & product prototypes

The screenshot displays a complex data table with multiple columns, likely representing material specifications, quantities, and costs. The interface includes various filters and sorting options, typical of a professional engineering or manufacturing software package.

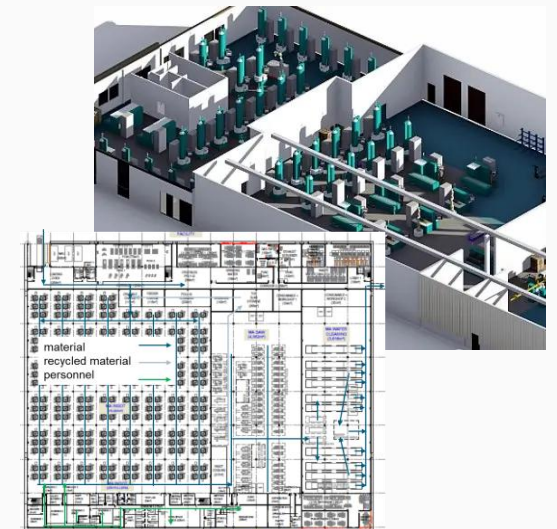
Integrated Resource-Efficient Fab Modelling

- Bottom-up analysis: energy/material flows & resource savings
- Integrated fab modelling: water & energy saving concepts
- Waste management concepts
- Digitalization concepts



Plant Simulation, Final Layout & Logistics Planning

- Virtual factory model (digital twin)
- Detailed factory layout
- Fab logistics planning
- Quality control planning



Line Ramp-Up & Process Start-Up Support

How do we ramp up our line and prepare our workforce?

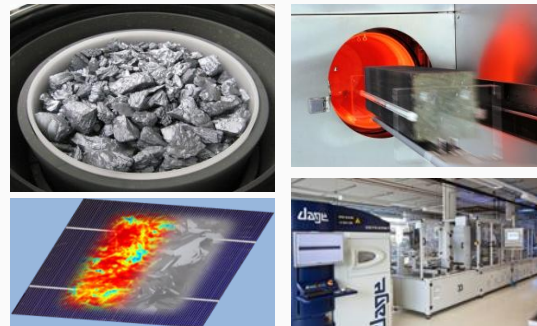
Ramp Up / Start Phase



- **FAT/SAT Precursor Manufacturing**
- **Process Transfer and Line Integration**
- **Workforce Training and Education**

FAT/SAT Precursor Manufacturing

- Process benchmarking: Fraunhofer ISE PVTEC references
- Cross-exchange of partly processed wafers, cells & modules
- Potential process limitations



Process Transfer and Line Integration

- Post-SAT line audit
- Fraunhofer ISE recipe transfer to customer lines
- On-site implementation support
- Process integration for line KPIs



Workforce Training and Education

- Future employee training: Train the trainers
- Scope: silicon feedstock to systems
- Training on Fraunhofer ISE pilot lines



Line Optimization, Product Certification & Long-Term R&D Cooperation

How do we optimize our line, certify our products and plan future development?

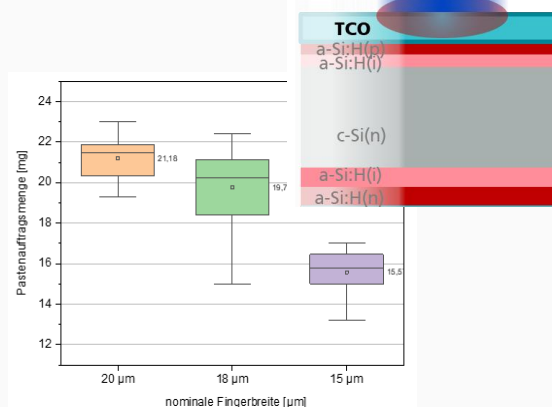
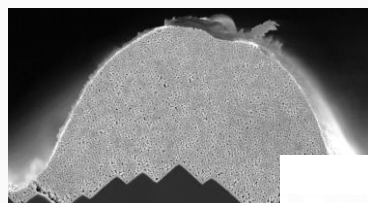
Operational Phase



- **Process Optimization**
- **Product Testing & Certification**
- **Long-Term R&D Cooperation**

Process Optimization

- Design of Experiments
- New materials, processes & recipes: implementation

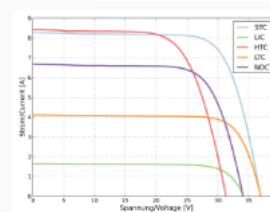


Product Testing & Certification

- Cell analysis & calibration
- Cell-to-module efficiency analysis
- Accelerated test design & execution
- Pre-certification testing
- Module certification: IEC 61215, 61646, 61730*
- “Quality Tested” module & PV plant certification*
- Solar resource assessment
- Outdoor performance monitoring



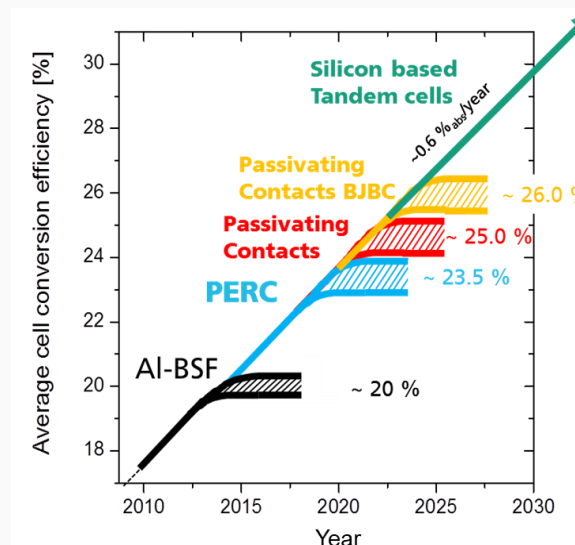
CalLab
PV Modules



*in cooperation with VDE Testing and Certification Institute **VDE**

Long-Term R&D Cooperation

- Product roadmap workshops
- Next-generation technology development



DataSpherePV® - The Complete Data Intelligence Turnkey

How to Integrate and Create Knowledge From Your Data?

Standard - MES focuses on

- Production steering, wafer tracking, measurement data distribution

Large data overwhelm and interfere with production steering

- MES only keeps short time data (hours)

The DataSpherePV® Data Lake

- Open data analysis platform
- Creating a secondary data pipeline
- Storing long-term production data, images, and any other relevant data
- Basis for learning algorithms
- Platform for running additional apps

Who's under the hood?

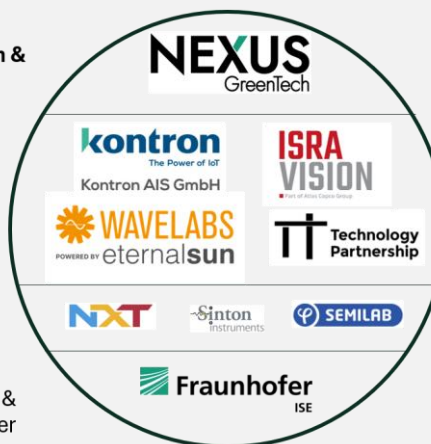
Innovation leaders in their segment, in a turnkey package

Integration & Turnkey

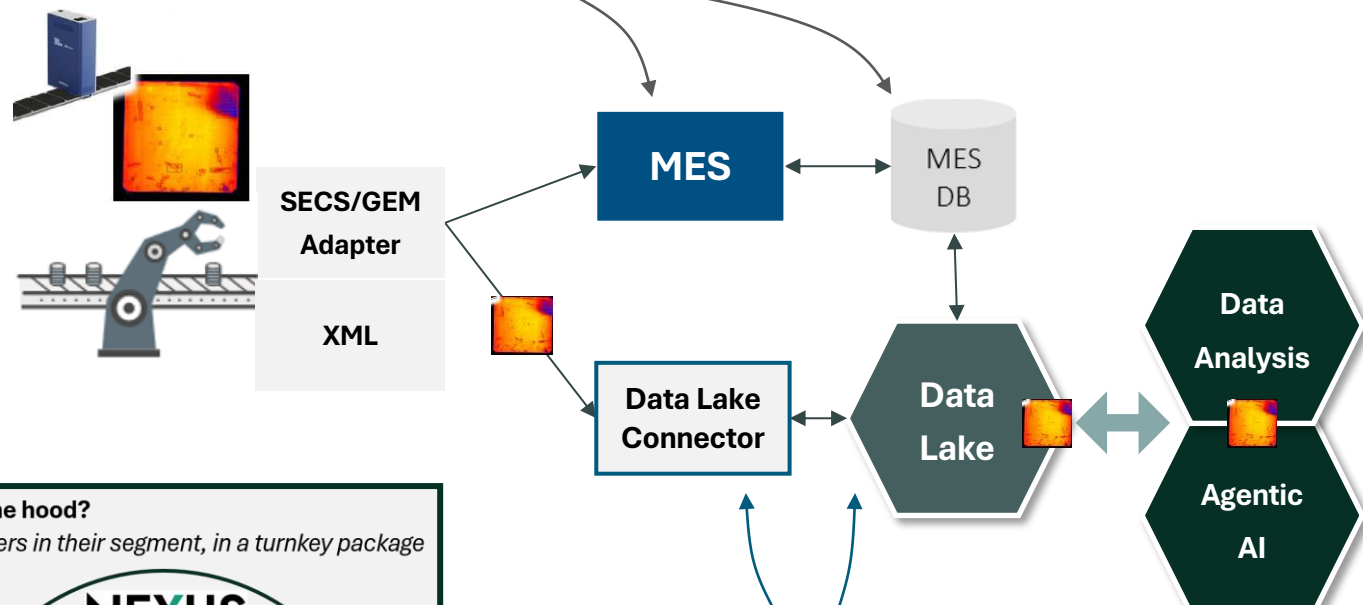
Turnkey Partners

Metrology adders

Innovation & R&D Partner



This is standard



This is new!

Knowledge creation enabled!

Which decision is next for your project?

You need support? Contact us!

Project guidance | Matching you with the right partners

Risk mitigation | Deep technology know-how

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