

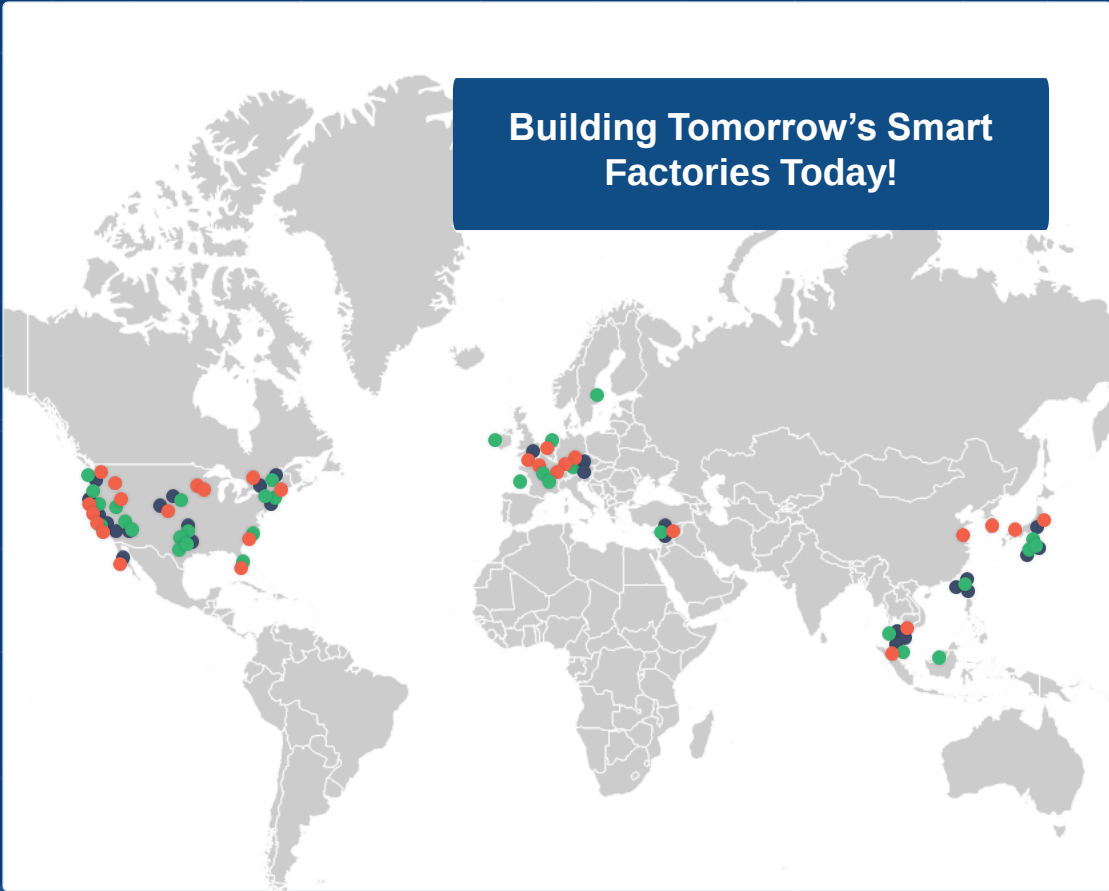
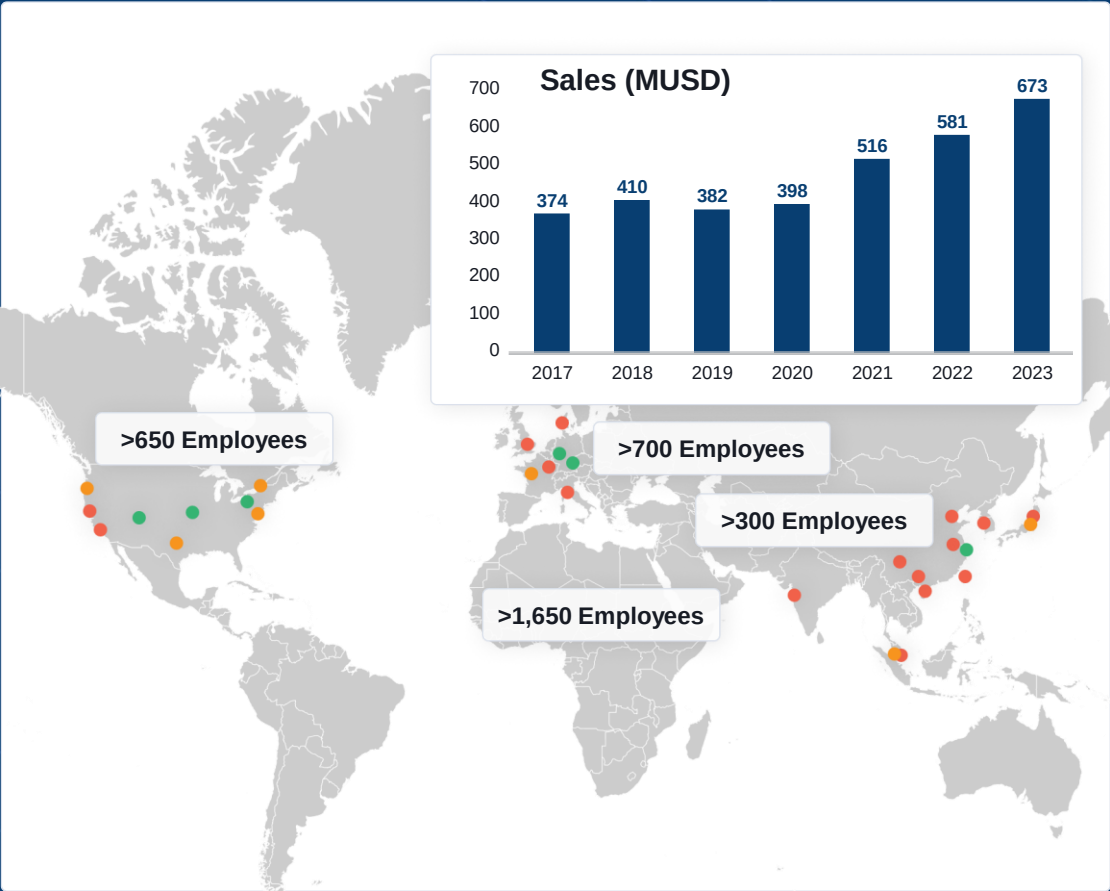
Your Path to Tomorrow's Autonomous Smart Factory

Semicon Europa CxO Summit

John Behnke

Smart Manufacturing GM, INFICON

INFICON Global & Semi Smart Manufacturing Presence



3 Main Centers of Competence:

Syracuse (US), Cologne (DE), Balzers (LI)

7 sales, application & service regions and 20+ local offices

- IMS Software Offices
- Sales and Offices
- Manufacturing Site

Global partnerships delivering Smart Manufacturing solutions

FPS	60+ Fabs (7 Backend)
FabGuard	50+ Fabs (5 Backend)
FabTime	30+ Fabs (2 Backend)

INFICON's Primary Markets

Other high-tech industries



Solar Energy



HVAC-R



Industrial Vacuum



Security & Environment



Lifescience



Battery & Auto

Semiconductor industry



Digital Twins



Factory Scheduling



Process Control & SmartSensors



Sustainable Sub Fab



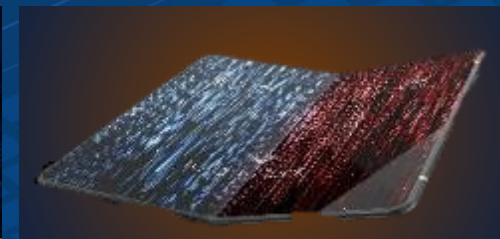
ICAPS



Tool Makers



Memory



Display



Leading Logic

Innovative Products for Tomorrow's Smart Factories

Smart Factory

- **Operations Digital Twin**
- Fully Integrated Factory Scheduling (FPS)
- Metrology Sampling Optimization (MSO)
- Comprehensive Reporting (FabTime & FPS)

Smart Tools

- **Process Equipment Digital Twin**
- Fault Detection and Classification (FabGuard®)
- SubFab Equipment Control
- AI-Based Anomaly Detection (SmartFDC)
- Maintenance Management (FabRecover)

Smart Sensors and Gauges

- Smart Process Aware Sensors (QCM, IRAD, OES)
- ML Spectral Data Analysis for Low Area Endpoint
- Leading Gauges and Leak Detection (SMART-Spray)



Sustainability Achievements in 2023

INFICON has made good progress at its manufacturing sites and is focusing on Scope 4 reductions

100%

certified green electricity used in all major production sites (2022: 81%)

37%

lower greenhouse gas emissions to 513 tons (2022: reduction of 34%)

84%

of energy carrier is electricity

48%

increased recycling of waste to 205 metric tons

23%

energy reduction for natural gas and heating



Mobility initiatives: share-a-ride, bike shelter, e-charging stations



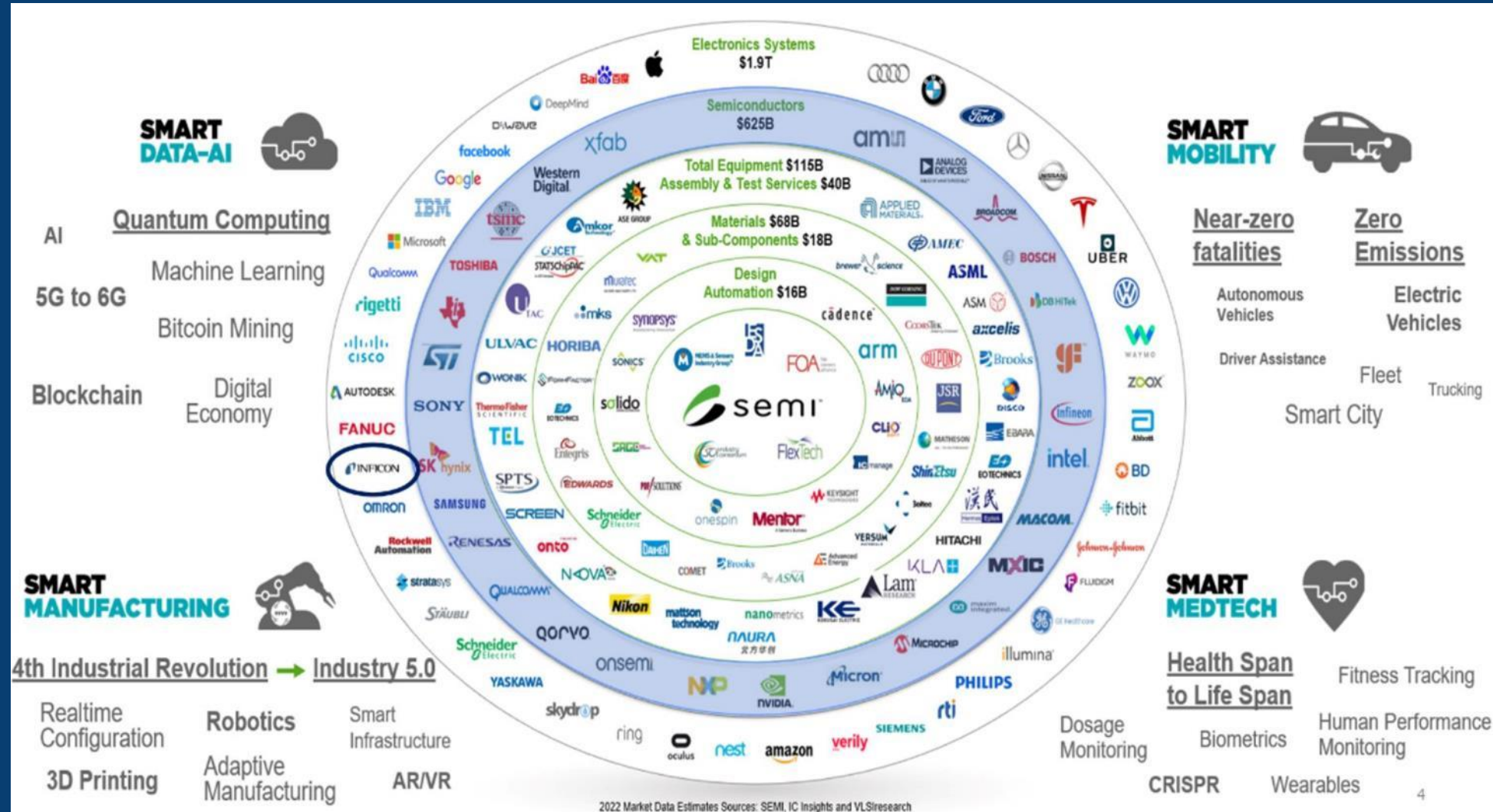
Plastic & packaging reduction: glass bottles, water dispenser, biodegradable pallet overwraps



Energy savings: innovative HVAC systems, optimizing of building and production infrastructure

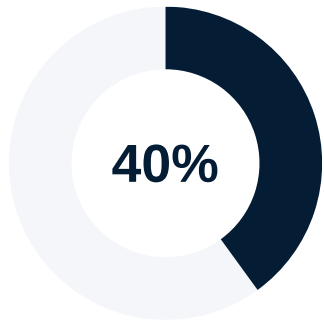
5 Years in a row continuous reduction in energy consumption per net sales

INFICON a Strategic Member of Semi Smart Ecosystem

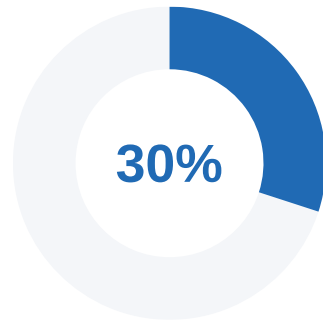


Estimated 2030 Semiconductor Market by Segment

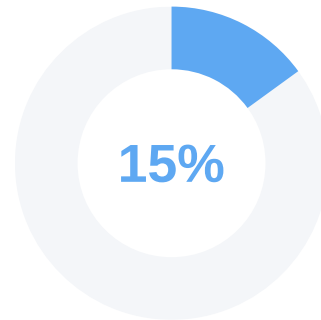
~1 Trillion USD Market



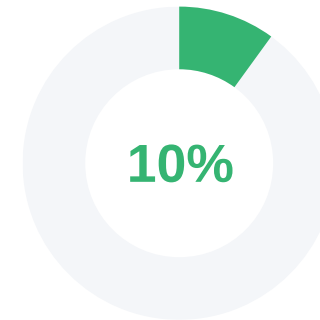
HPC



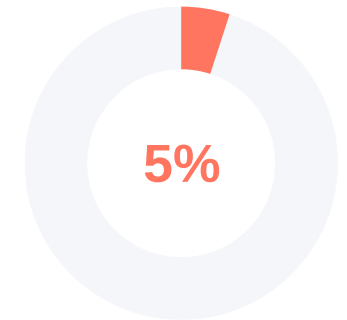
Mobile



Automobile

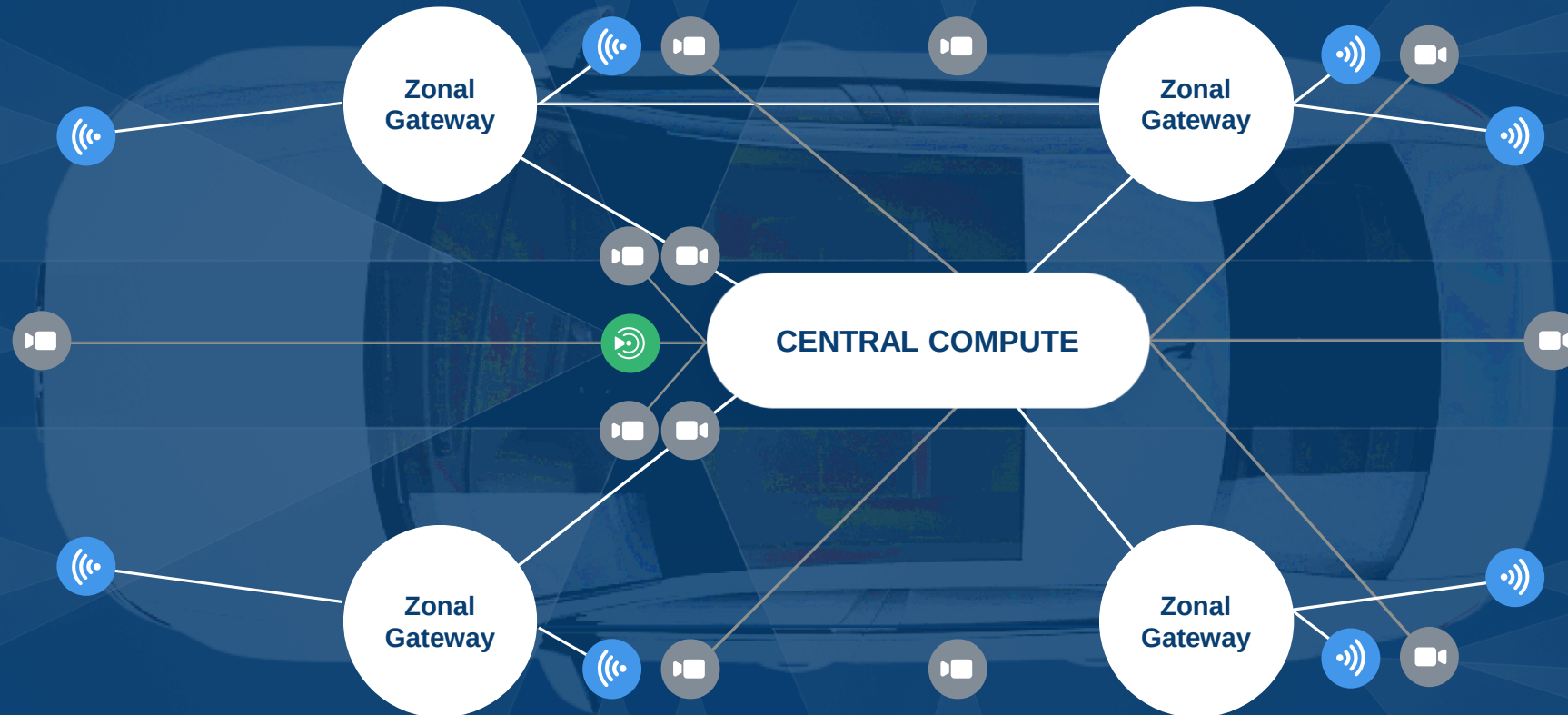


IoT

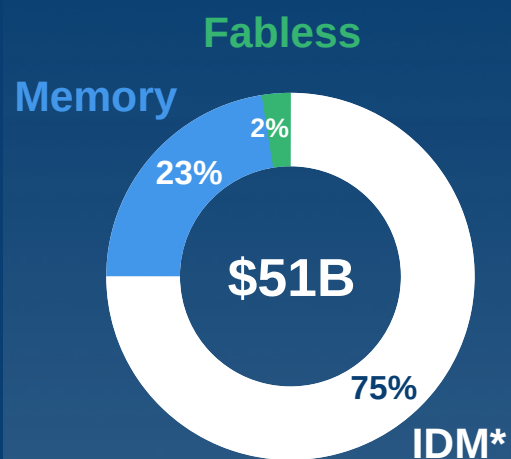


Others

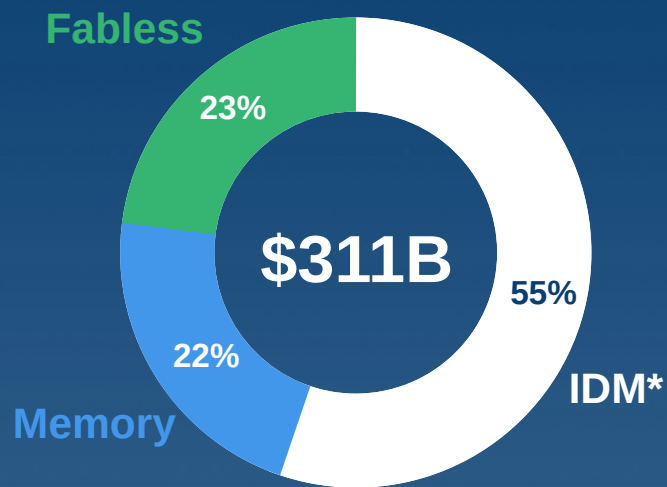
Automotive Migrating Towards Central Compute Design



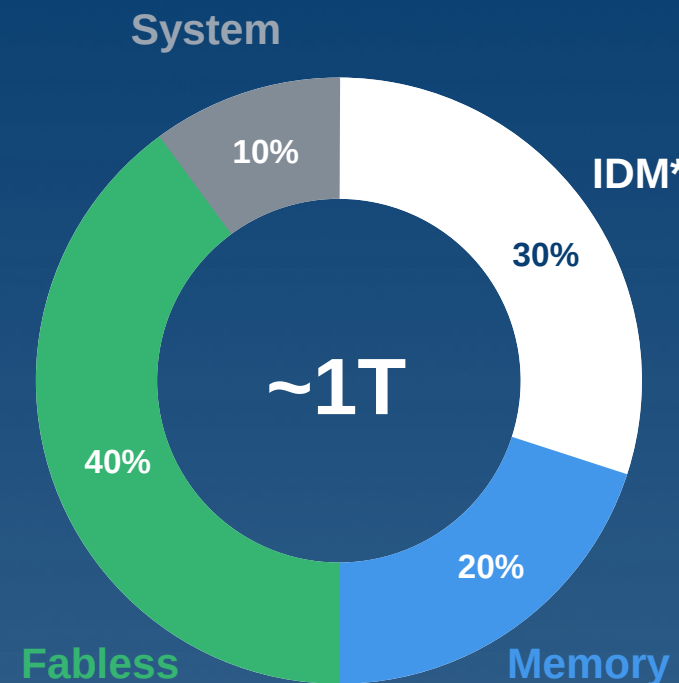
Fabless Demand Driving Foundry Growth



1987 1990



2010



2030 (FCST)

*IDM excluding memory

Source: © 2024 IEEE International Solid-State Circuits Conference

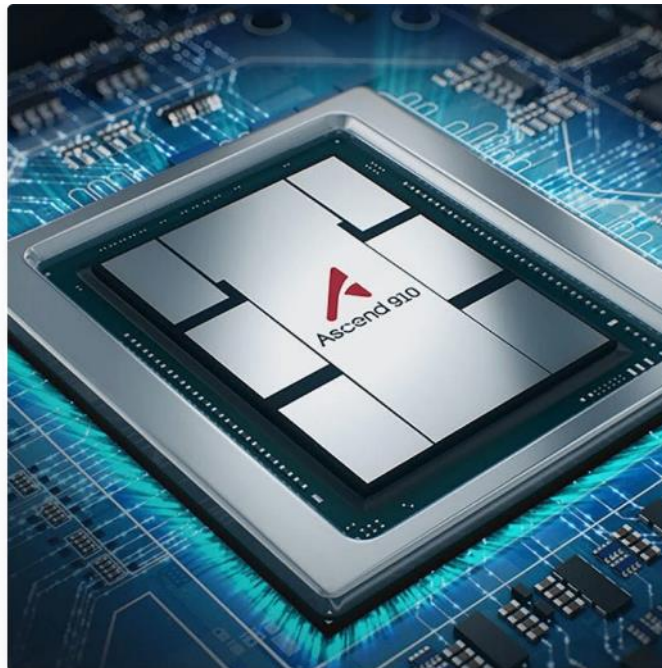
Increasing Legacy Competition

Huawei's AI chips take another step forward as Chinese firms look for Nvidia alternatives

Huawei is sending out samples of its Ascend 910C processor for testing as the tech giant races to fill a void left by Nvidia

Reading Time: 2 minutes

energy gross sales status summary



FORTUNE

China is poised to dominate the market for legacy chips, and the U.S. may only have itself to blame



Fortune - NurPhoto/Getty Images

Lionel Lim
July 6, 2024 • 6 min read



In April, U.S. Commerce Secretary Gina Raimondo **took the stage** in the Belgian city of Leuven with a warning: “About 60% of all new ‘legacy chips’ coming into the market in the next handful of years will be produced by China,” she told reporters.

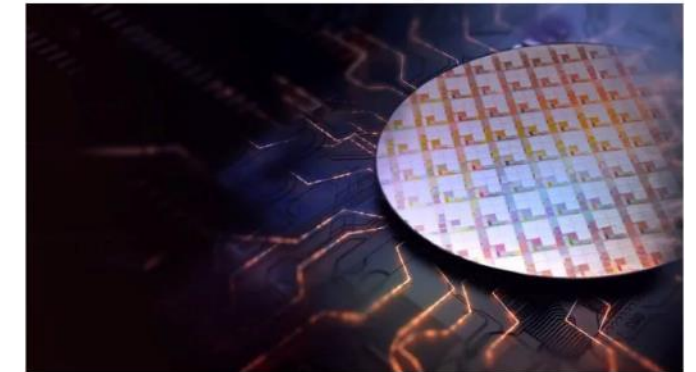
US sanctions transform China into legacy chip production juggernaut — production jumped 40% in Q1 2024

News By Aaron Klotz published April 17, 2024

The U.S. purposefully excluded older chips from its export sanctions.

Comments (35)

When you purchase through links on our site, we may earn an affiliate commission. [Here's how it works.](#)



(Image credit: HLMC)

U.S. semiconductor export sanctions could be backfiring: China's output of legacy semiconductor chips grew by a whopping 40% in the first quarter of 2024, according to a report from SCMP. The massive surge in production suggests China could become the global leader in legacy chip production.

Expectations for Smart/AI Solutions are High

Samsung plans to eliminate humans from its chip fabs by 2030 — push for full automation continues at full steam: Report

News By Anton Shilov published January 3, 2024

Fully automated chip fabs may be here sooner than we think.

Comments (11)

When you purchase through links on our site, we may earn an affiliate commission. [Here's how it works.](#)



(Image credit: Samsung)

Intel puts 1nm process (10A) on the roadmap for 2027 — also plans for fully AI-automated factories with 'Cobots'

News By Paul Alcorn published February 28, 2024

1nm chips to arrive in late 2027.

Comments (27)

When you purchase through links on our site, we may earn an affiliate commission. [Here's how it works.](#)



(Image credit: Tom's Hardware)

Sam Altman Seeks Trillions of Dollars to Reshape Business of Chips and AI

OpenAI chief pursues investors including the U.A.E. for a project possibly requiring up to **\$7 trillion**

By Keach Hagey [Follow](#) and Asa Fitch [Follow](#)
Feb. 8, 2024 9:00 pm ET

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Listen (2 min)

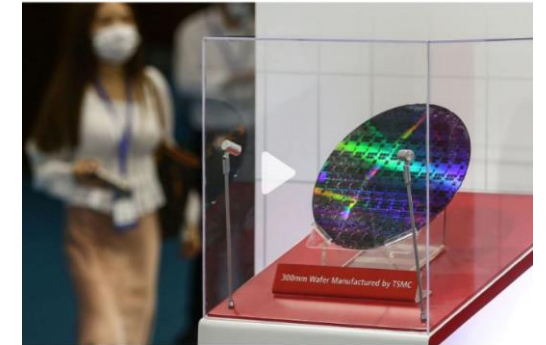


The technology behind generative AI has exploded, fueling a demand for chips that can handle the needed processing power.

Taiwan's TSMC to invest \$2.9 billion in new plant as demand for AI chips soars

By Yuhua Liu [Follow](#)
2 minute read · updated 11:50 PM EDT, Tue July 26, 2023

Share



Video Ad Feedback



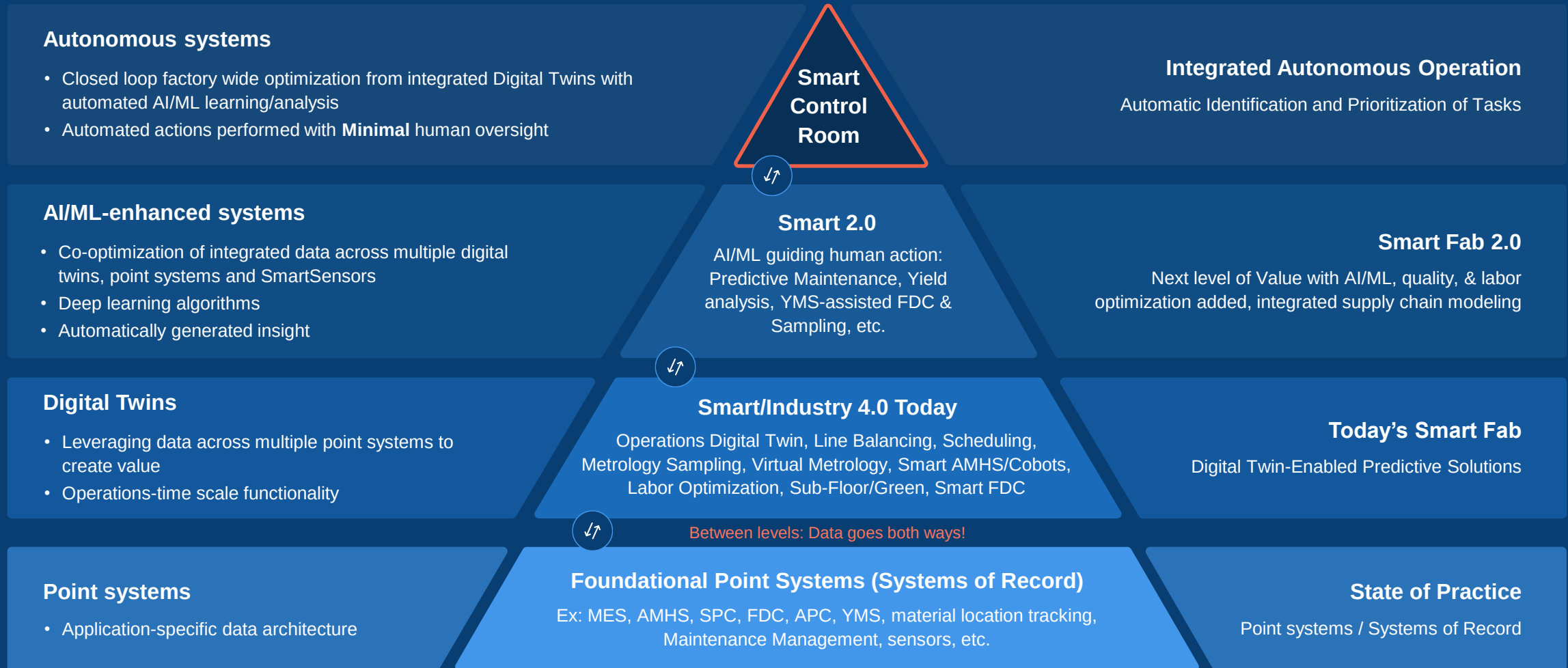
**NIST Manufacturing
USA Digital Twin
Institute**



”

Intel now plans to use AI in all segments of its production flows, from capacity planning and forecasting to yield improvements and actual floor-level production operations, in a '10X moonshot' effort.

Semi's Smart Roadmap: Point Systems to Autonomous Solutions



INFICON Digital Twins

INFICON Contribution



Operational Digital Twin: Digital Twin technology tailored to semiconductor manufacturing

Integration with Process Control: Monitor, predict, and optimize semiconductor processes

Real-time Data Integration: Common aggregation of all relevant fab/process/yield data

Digital Twin Evolution:

Migrating from independent Digital Twins to Co-Optimized Digital Twins and the Autonomous Factory Control Room

Operations Management

Source Systems

MES



Files



RMS, AMHS/MCS, EI,
APC/SPC, Planning, More...

Process and Subfab



INFICON Digital Twin



Open Database for Direct
Access and Integration Into
Other Systems



Scheduling and WIP Improvements

Most Widely Adopted Solution in the Semiconductor Industry

CASE STUDIES AND EXAMPLES FROM 15+ YEARS OF SCHEDULING

Typical Results from Scheduling

Full Factory ROI Examples from Multiple Fabs:

- On-time delivery increased by 19%
- Reduction in fab cycle time by 24%
- Increase of overall factory output by 14%
- Reduction in Standby With WIP by 75%
- Increase in shift completes by 14%
- Reduced lot lead time for reticles by 95%
- Capacity Increases

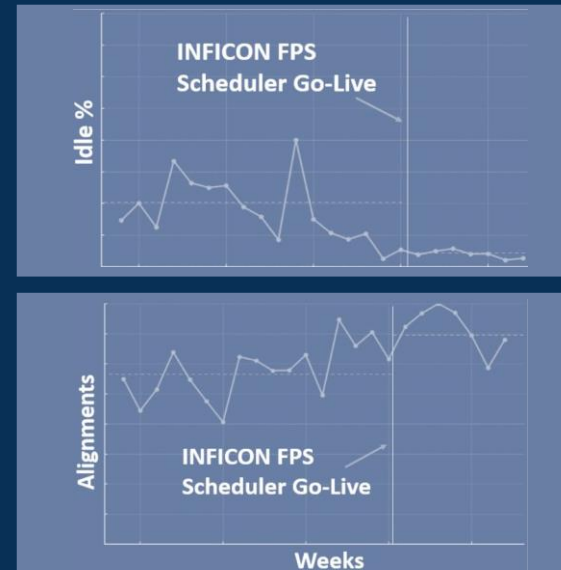
Observed Capacity Increases

- Diffusion: 20%
- Thin Film: 11%
- Implant: 15%
- Litho: 9%

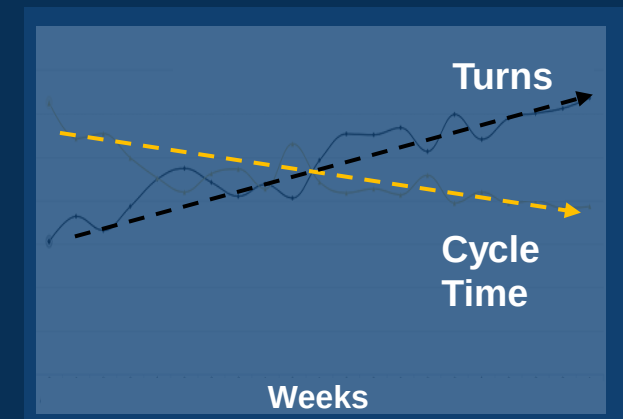


ST Microelectronics

- Idle time variation decreased 46%
- OEE improvement of 5%
- Alignment output increased by 4%



- Litho turns Increased by >30%
- Priority lot cycle time reduction of 25%
- Stand By With WIP reduced 50%
- Area Cycle time improvement of 1 Day



Integrating Delivery and Smart Scheduling

+33%

Increased OHV capacity with optimized routing and tool-to-tool transfer. (300 mm)



Intelligent routing increases stocker capacity, eliminates static stocker assignments and reduces manual moves. (200 mm)



Murata OHV (Large Multi-Fab 300 mm)

Intelligent scheduling provided record utilization of OHV of 1.2 moves per step creating Best-in-Class efficiency.



Kuka Robots (Large Multi-Fab 200 mm)

Automated robots for precise, autonomous loading of material eliminating the need for human action.



Romarc & Omron (Large Multi-fab 200 mm)

Seamless interaction between AMHS, Cobots, and Operators reduced overall distance traveled. Inter-building moves driven by scheduling.



Omron (200 mm Single Fab)

Scheduler drives intelligent lot movement between critical areas, optimizing flow with minimal human oversight.



Typical benefits include

- Increased operator value-add time
- Lots sent to the closest stocker
- Solves rail and stocker capacity issues



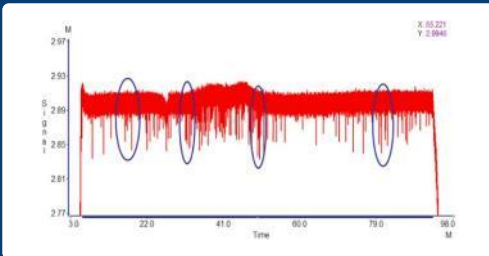
Seamless integration with industry-leading systems ensures flexible, scalable solutions across legacy and state of the art factories.

Tool and Process Digital Twins

Augmented with Smart Sensor Data

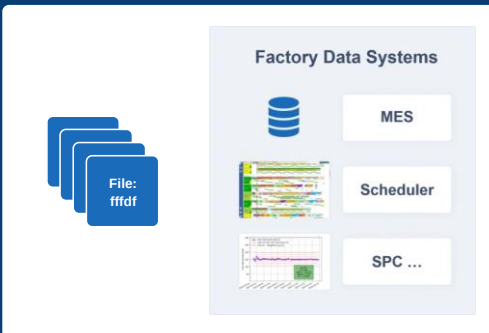
High Speed Analog & IoT

- 1Hz to 1.25MHz
- Arc Detection
- Analog integration
- Vibration



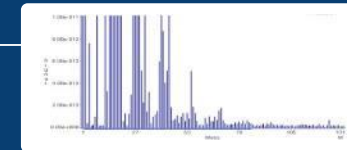
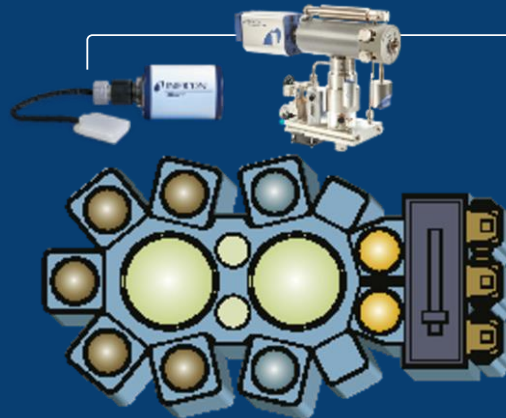
Digital Twin & Metrology Data

- Tools that only generate files
- Factory Data Systems (FPS, MES, etc.)
- Advanced analysis for existing FDC



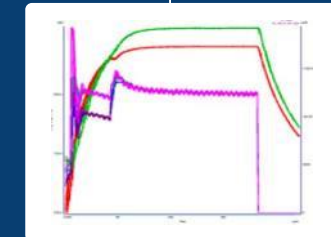
SmartSensor Data

- RGA
- RF
- OES



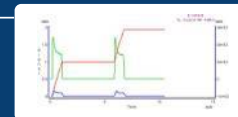
Tool Data

- SECS
- OPC
- Message Bus
- Files



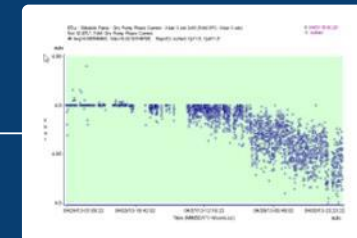
Gauge Data

- MFC
- Liquid Flow Sensor
- Thermocouple



Facilities and Subfab Data

- Abatement
- Pumps
- Chillers
- Gas Bottles/Chemical Delivery



Continuously Expanding Sensorization in Semi

Innovating and expanding our sensors technologies to serve the applications below (and beyond)

Harsh Process Monitoring

- ALD, PECVD, Etch: High ROI, process chemistry survivability
- Reaction byproduct, end point & contamination detection



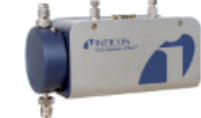
Process Monitoring with QCM Sensors

- Precursor Monitoring, Process Monitoring, End point detection
- Insitu metrology



Process Monitoring with Optical & Acoustic Sensors

- Precursor Monitoring with NDIR, Composer, HCD
- Process Monitoring, End point detection with HP100



Trace Gas Analysis

- Fab cleanliness requirement tool/part qualification
- High Resolution Full spectrum analysis with i-TOF
- QMG 800 Next Gen Analytical Mass Spec

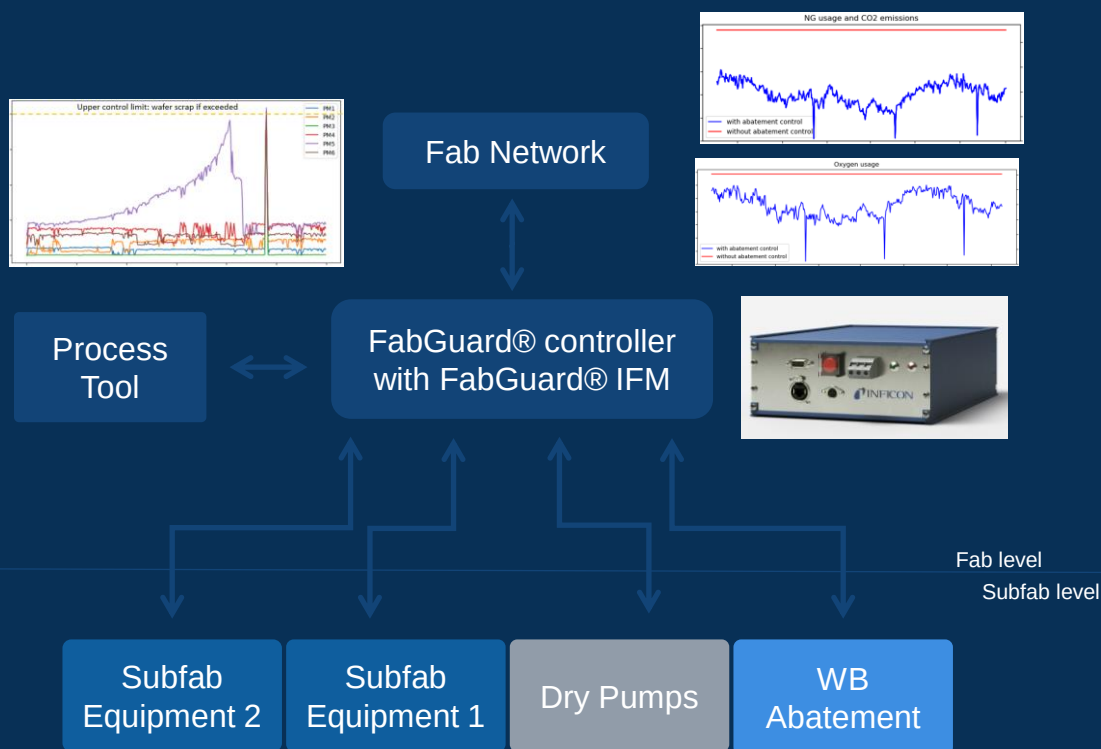


Plasma Process Monitoring

- Non-invasive process monitoring RF Sensor, Discriminative FDC
- Micro arc detection & RF pulse chamber matching



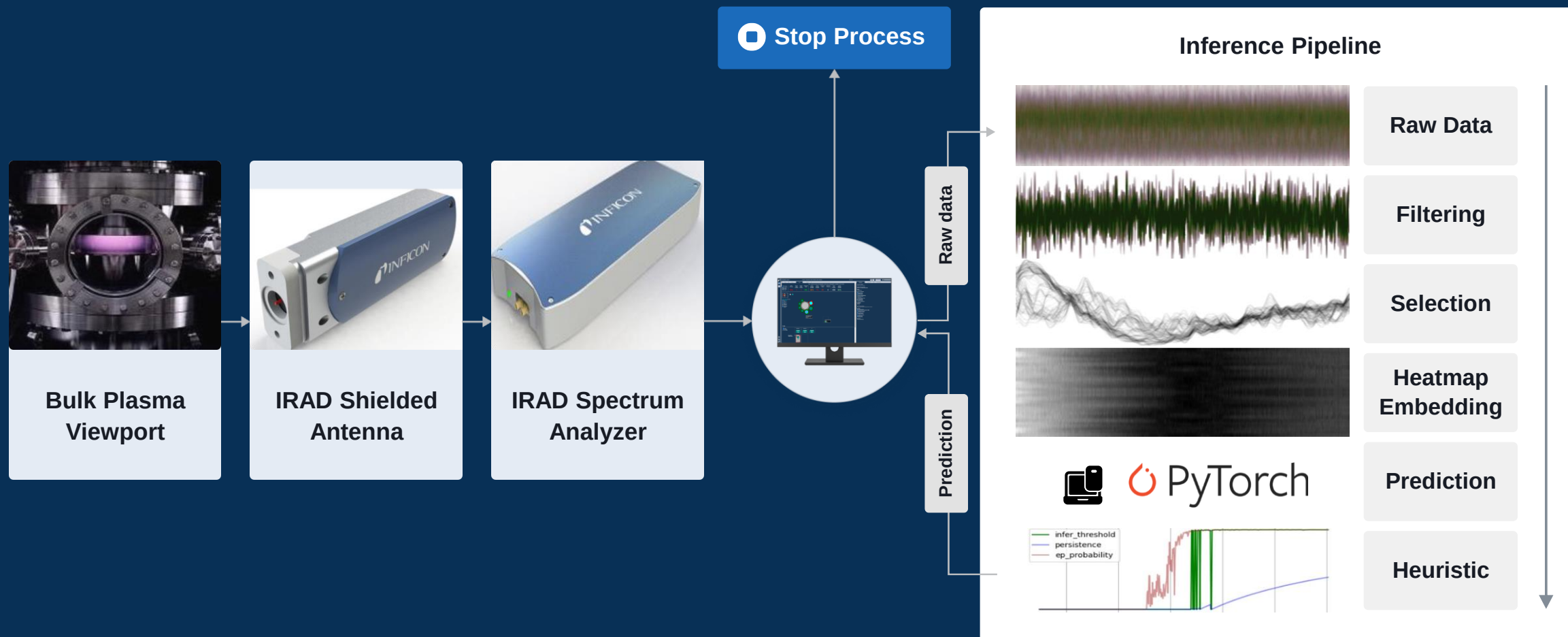
Meeting Industry Sustainability Goals: Intel Case Study



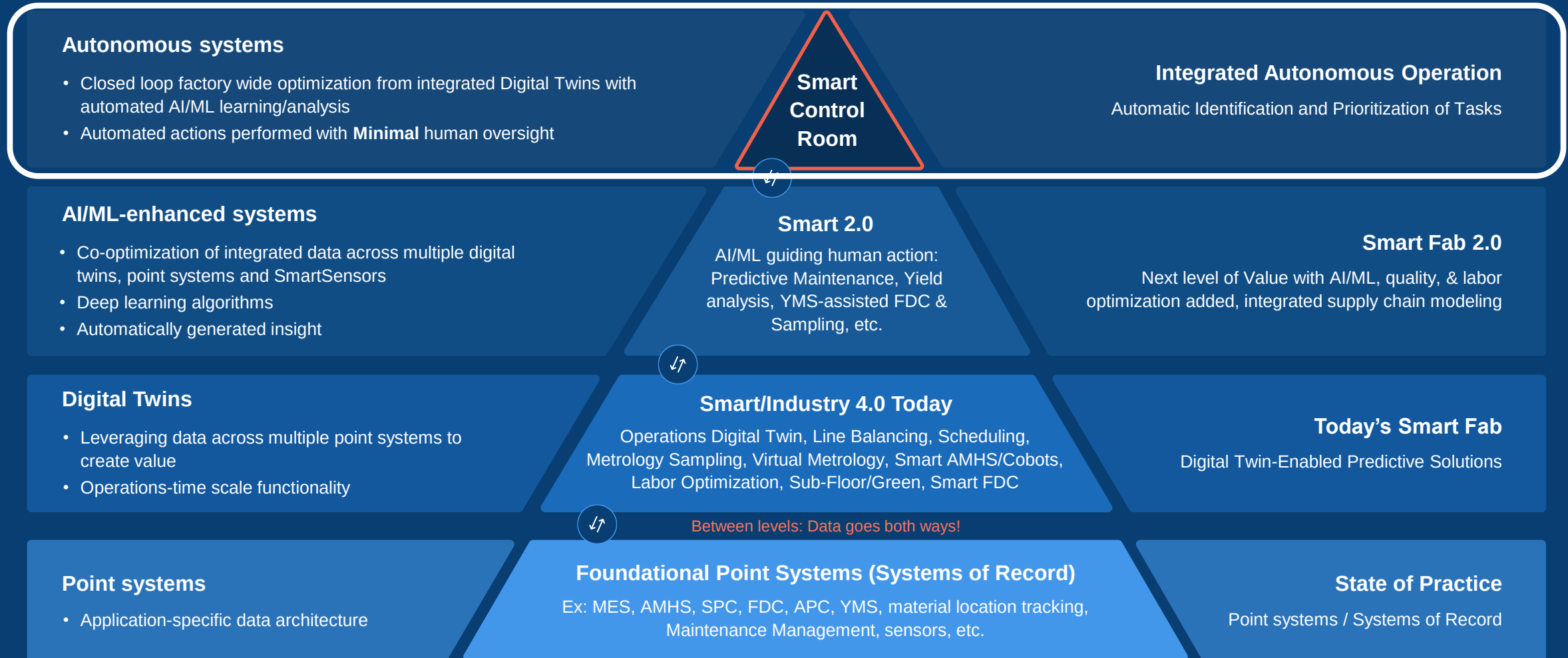
Utility/Emission % Savings

NG	58%	✓
CO2	58%	✓
NOx	58%	✓
CO	58%	✓
O2	34%	✓

SmartSensor AI Low Open Area Etch-endpoint Detection



Semi's Smart Roadmap: Point Systems to Autonomous Solutions



Developing Tomorrow's Smart Control Room



INFICON Smart Control Room History



- ✓ Helped establish Semi roadmap and vision
- ✓ JDP with ST to develop initial elements
- ✓ Leading Semi Smart Control Room working group
- ✓ Coordinating upcoming AI Enabled Semi Factory Control Room Vision session at NASA

Autonomous Smart Control Room Draft Vision



- Co-optimization of Digital Twins
- ID of all Fab "Issues": AI/ML anomaly detection...
- Business objective-based impact assessment
- Autonomous reaction to most anomalies
- Remote control of floor tools
- Prioritize/assign/track tasks
- Learning's fed back into AI engines

Join Us in “Building Tomorrow’s Smart Factories Today”

Industry Collaboration:

- Annual User Group Meetings
- CHIPS Act
- Digital Twin Institute
- SEMI Smart Manufacturing



Broader Ecosystem Impact:

- Drive fab optimization, maximize yields and reduce environmental impact
- Contributions to industry roadmaps
- INFICON's solutions are a foundation for Smart fabs

Control Room Role:

- INFICON's Control Room Vision
- Provides a centralized view of future operations
- Optimizing fab-wide performance



Synergies with Partners:

OEMs, fabs, government & industry consortia

Visit Us at Booth C1726

Other INFICON Presentations

Why Digital Twins Matter

Fab Management Forum | Nov. 13

J. Behnke

From Insight to Action: Elevating Employee Efficiency with Smart Detection and Targeted Data Delivery

Smart Manufacturing Forum | Nov. 14

H. Smith & T. Gimming (ST Microelectronics)

Thank You!