

## Semiconductor Equipment Sales Forecast to Reach Record \$109 Billion in 2024

Global sales of total semiconductor manufacturing equipment by original equipment manufacturers are forecast to set a new industry record, reaching \$109 billion in 2024, growing 3.4% year-on-year, SEMI announced today in its *Mid-Year Total Semiconductor Equipment Forecast — OEM Perspective at SEMICON West 2024*. Semiconductor manufacturing equipment growth is expected to continue in 2025, with sales forecast to set a new high of \$128 billion in

2025, driven by both the front-end and back-end segments.

“The growth in total semiconductor manufacturing equipment sales already underway this year is forecast to be followed by a robust expansion of roughly 17% in 2025,” said Ajit Manocha, SEMI president and CEO. “The global semiconductor industry is demonstrating its strong fundamentals and growth potential supporting the diverse range of disruptive applications emerging from the Artificial Intelligence wave.”

### Semiconductor equipment sales by segment

After registering a record \$96 billion in sales last year, the wafer fab equipment segment, which includes wafer processing, fab facilities and mask/reticle equipment, is projected to increase 2.8% to \$98 billion in 2024. This marks a notable increase from the previously forecasted \$93 billion in SEMI’s 2023 Year-End Equipment Forecast. Ongoing strong equipment spending in China and substantial

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## How Etch Breakthroughs Are Tackling 3D NAND Scaling Challenges on the Path to 1,000 Layers

While much discussion has been had regarding compute and new memory types, such as high bandwidth memory (HBM), the rise of AI applications is also placing new demands on NAND storage. These applications require ever-increasing capacity to support data requirements for memory-intensive processing and AI training models.

The challenge for 3D NAND manufacturers is to

continue to scale density and capacity, while still delivering it at a cost that is right for the market. 3D NAND storage scaling has largely been done by stacking layer upon layer of oxide and nitride layers (ONON) and etching holes, also referred to as memory channels, through them. The nitride in the ONON stack is a sacrificial layer and is replaced with tungsten to form the word line (FIGURE 1). However,

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find out more



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 **EDWARDS**



**Semiconductor**

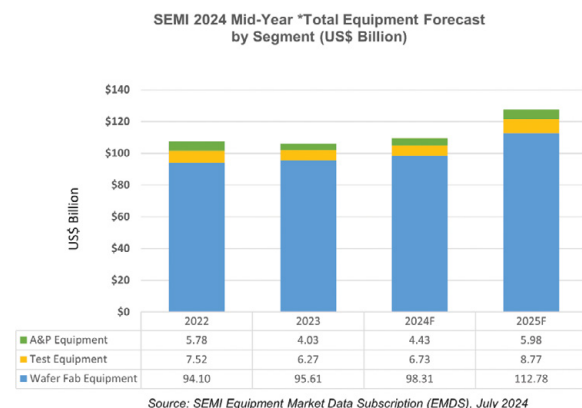
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investments in DRAM and HBM, driven by AI computing, drove the upward revision. Looking ahead to 2025, Wafer fab equipment segment sales are projected to expand 14.7%, reaching \$113 billion due to increased demand for advanced logic and memory applications.

Following two years of contraction caused by challenging macroeconomic conditions and softening semiconductor demand, the back-end equipment segment is anticipated to start its recovery in the second half of 2024. Specifically, sales of semiconductor test equipment are projected to rise 7.4% to \$6.7 billion in 2024, while assembly and packaging equipment sales are predicted to increase 10.0% to \$4.4 billion in the same year. Furthermore, back-end segment growth is expected to accelerate in 2025, with test equipment sales surging 30.3% and assembly and packaging sales increasing 34.9%. The segments' growth is supported by the increasing complexity of semiconductor devices for high-performance computing and the expected recovery in demand for automotive, industrial, and consumer electronics end-markets. Additionally, back-end growth is expected to increase over time to process ramping supply from new front-end fabs.

### Wafer Fab Equipment (WFE) sales by application

The sales of Wafer Fab equipment for foundry and logic applications are expected to show a moderate contraction of 2.9% year-over-year to \$57.2 billion in 2024 as a result of softening in demand for mature nodes and higher than expected sales for advanced nodes in the previous year. The segment is forecast to grow 10.3% in 2025 to \$63.0 billion, driven by



\* Total equipment includes new wafer fab, test, and assembly and packaging. Total equipment excludes wafer manufacturing equipment. Totals may not add due to rounding.

increasing demand for leading-edge technology, the introduction of new device architectures, and increased capacity expansion purchases.

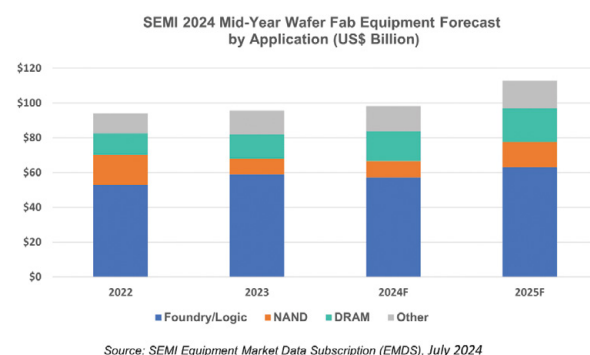
Memory-related capital expenditures are projected to see the most significant increase in 2024 and demonstrate continued growth in 2025. NAND equipment sales are expected to remain relatively stable in 2024, with a 1.5% increase to \$9.35 billion, as supply and demand normalize, setting the stage for a 55.5% expansion to \$14.6 billion in 2025. Meanwhile, DRAM equipment sales are projected to grow strongly at 24.1% and 12.3% in 2024 and 2025, respectively, supported by surging demand for high-bandwidth memory (HBM) for AI deployment and ongoing technology migration.


### Semiconductor equipment sales by region

China, Taiwan and Korea are expected to remain the top three destinations for equipment spending through 2025. China is projected to maintain the top position over the forecast period as the region's equipment

purchases continue to rise. Equipment shipments to China are projected to exceed a record \$35 billion in 2024, solidifying its lead over other regions. While equipment spending for some regions is expected to fall in 2024 before rebounding in 2025, China is expected to see a contraction in 2025 following significant investments over the past three years.

The SEMI forecast is based on collective input



from top equipment suppliers, the SEMI *Worldwide Semiconductor Equipment Market Statistics* (WWSEMS) data collection program and the industry-recognized SEMI *World Fab Forecast* database. 

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**Etch**

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in recent years, scaling has become more difficult and complex.

“As the industry now looks towards the 1,000-layer roadmap by the end of decade or soon thereafter, there are some critical challenges. We are working actively with our leading customers to address these in time through innovations in etch, as well as other advanced manufacturing processing steps,” said Dr. Harmeet Singh, Group Vice President and General Manager of the Etch Product Group at Lam Research.

Lam has vast experience in etch, including more than 20 years as the dry plasma etch market leader and more than 10 years and 7 device generations as the NAND high aspect ratio etch market leader. “More than 100 million NAND wafers have had their memory channel created by Lam dielectric etchers,” Singh said.

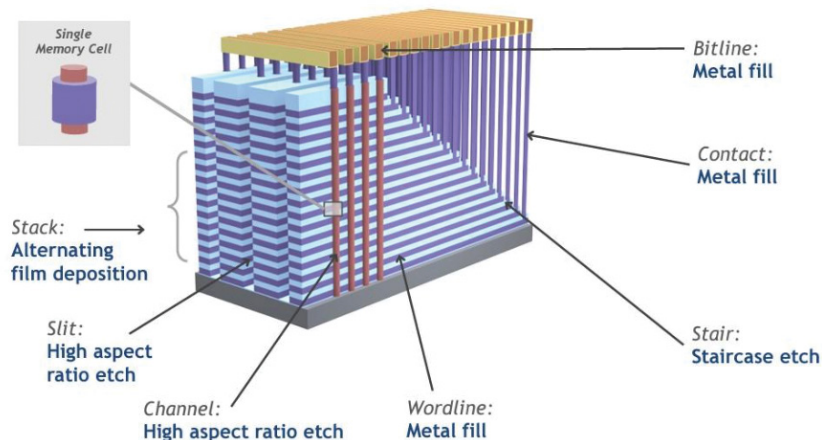
### The 1,000-layer HAR etch challenge

When creating 3D NAND, essentially, the number of oxide and nitride layers determines the number of memory cells and thus the memory density and capacity of the device. Each vertical memory string begins with the creation of a cylindrical hole, which might be approximately 100nm in diameter and 5-6  $\mu\text{m}$  deep (an aspect ratio of 50-60:1) and penetrate 128 layers.

The difficulty of etching very deep and precise high-aspect ratio (HAR) cylindrical holes only increases with the number of layers and the corresponding stack thickness. When hundreds of layers of ONON films are patterned to create holes with a critical dimension of 100-115 nm, this pushes the etched aspect ratio (depth/width) above 100:1.

“The depth of the hole relative to its diameter is now greater than 50 to 1,” Singh said. “As vertical scaling happens, the number of layers and hole depth is increasing, but the diameter generally has been held constant.” This means that 1,000-layer 3D NAND, comprised of multiple tiers, may require a hole with an aspect ratio of as much as 100:1. “This requires that the memory channel etch have atomic precision” he said.

Creating such a high-aspect ratio hole at such small dimensions is hard to comprehend, especially when you consider that the “profile” of the hole must be near perfect from top to bottom, and, in production, a 100 trillion of them may be formed across a 300 millimeter wafer. Singh says that creating this highly precise channel shape is critical for vertical scaling, lateral scaling, and logical scaling (such as going from TLC to



QLC and beyond).

“Typically, physics and chemistry would drive the bottom of this cylinder to be smaller than the top of the cylinder when we etch because there is intrinsic limitation of reactant species getting to the bottom of the feature,” Singh explained. “The cylinder has a tendency of turning into something of a cone.”

### The solution

One solution to creating a perfect cylinder, says Singh, is a pulsed power plasma technology developed by Lam that uses very high power in very short bursts. “As the stack gets taller, we have been driving the ion energy higher,” he said. “The beauty of this is we have been keeping the average power constant but increasing the peak power in the pulses. This drives higher efficiency from the ions,” he said.

Lam has also employed new “cryogenic” etching, which enables the usage of a special mixture of etch gases, which in combination with other etch innovations, helps to get a near perfect profile in very high-aspect ratio holes. Cryogenic, or low-temperature etching, is a term applied to etching processes below 0°C. According to a recent paper by Lam Research, at such low temperatures there is a transition from chemisorption to physisorption, which is defined as a process in which chemical bonds are not formed upon adsorption. This leads to a higher neutral concentration on the surface and higher etching rates due to physisorption of undissociated neutral species. Enhanced adsorption of etching by-products enables profile control without the addition of polymerizing gases [1].

“The stacks have become so tall that we have transitioned and innovated in the chemistry used for cryogenic etching, and that has increased the synergy with the neutrals that are involved in the etch to get

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**Etch**


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even higher etch rates than before,” Singh said.

Lam cryo etching technology — which combines high peak-peak voltage processing, cryo wafer temperatures, and process chemistry innovation — delivers 2.5x faster etch rate with 2x improvement in profile precision compared to conventional HAR etching.

Lam, which has more than 7,500 HAR dielectric etch chambers in production, was the first company to introduce cryogenic HAR etching into high volume production in 2019. More than five million wafers have been etched using Lam cryogenic processes on an installed base approaching 1,000 etch chambers.

“This has been a very fruitful journey

for us. We have helped our customers transition NAND from 2D to 3D NAND, and scale 3D NAND to where it is today. Continued innovation in etch will be key to enabling the way to 1,000-layer 3D NAND,” Singh said. 

**METHODS AND EQUIPMENT**

1. T. Lill, et al., “Dry etching in the presence of physisorption of neutrals at lower temperatures,” J. Vac. Sci. Technol. A 41, 023005 (2023).

## New Processes and Priorities Pose New SubFab Challenges

To meet the requirements of next generation devices, chipmakers are developing processes that use new materials, run at lower or higher temperatures and at different pressure regimes. New etch processes for 3D NAND, for example, are run at cryogenic temperatures, and new precursors for chemical vapor deposition (CVD) and atomic layer deposition (ALD) include a variety of metalorganic sources. At the same time, companies are increasing their scrutiny of energy consumption and sustainability goals.

These trends are creating new challenges for the equipment in the subfab, particularly vacuum pumps and gas abatement systems that must now handle new types of materials and their process byproducts, and at greater volumes. “The range of CVD precursor materials and reaction by-products prone to condense in process chamber vacuum systems is expanding,” said Neil Garland, VP marketing, Dry Pumps at Edwards.

Another trend is that a smaller proportion of the chemicals and precursors that go into the process



chamber actually end up on the wafer. “Therefore, more goes out of the chamber into the vacuum system and the abatement system,” Garland said. “We are getting nastier stuff and more of it.”

Huge megafabs are now under construction in the U.S. and around the world, but space is still at a premium, particularly in the subfab. “Demands for higher throughput are leading manufacturers to run more chambers per tool, providing less space in the subfab,” Garland said. “Following the convention that supporting systems must fit within the shadow of the process tool as projected down to the subfab, pumps and abatement must

also fit in less space while handling increased flows.”

Energy consumption and sustainability are now a higher priority for chipmakers and this also impacts the design of tools and systems in the subfab. “Manufacturers are demanding more energy efficient systems, often for the simple reason that it reduces operating costs, with a sustainability aspect secondary to this,” Garland said.

**New challenges, new solutions**

Vacuum pump suppliers are working to adapt. “We thought we covered every conceivable angle with a pump that runs at about

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**New Process**

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190 degrees, but now we are looking at products that are going to have to run hotter than that. And in some instances, pumps are going to have to run a lot cooler to minimize corrosion issues as well,” Garland said.


Colin Reid, VP marketing, Abatement and Integrated Systems, at Edwards, said the new processes and materials are creating challenges on the gas abatement side as well. “Post vacuum pump, it’s really about management of our byproducts, keeping the fab safe and free from the challenges that those byproducts bring to the fab. Obviously, being certified to local environmental specifications is an important aspect as well.

Edwards offers Smart Thermal Management Solutions (TMS) that

provide reliable and accurately controlled heating of forelines and process exhaust pipes to prevent blockage by condensed by-products or residual process materials. Reid said, 30 years ago, TMS at 120°C was the norm. “Now it’s double that temperature, even on the atmospheric side.”

Reid said finding solutions to new challenges often comes with vital support from the Edwards on-site teams. “We’ll do our best to give the customer a solution based on what the chamber process gases are and what we believe will happen to that gas or precursor as it moves through the foreline and exhaust pipeline. Having our service / applications teams in the sub-fab monitoring

our product performance is very important to us,” he said. “Once we see what’s going on, we have the ability to react really quickly to actually make sure we give the customer the uptime and performance that they need.

“We do a lot of theory and applications work. Having the ability to go in and witness a problem that we weren’t expecting — or a scenario happening a lot faster than we thought it would — we can then make some changes,” Reid continued. “The product solution has to be right, and our on-site team in the sub-fab must work exceptionally well, working closely with the customer to ensure all their outcomes are met.” 

## HORIBA Showcases New IR Gas Analysis and Particle Detection Systems

HORIBA, exhibiting at Booth #1433 at this year’s SEMICON West, has a range of products for process metrology and control, ranging from gas and liquid flow components to particle detectors for CMP and complex concentration monitoring equipment.

The company will be showcasing its new Laser Gas Analyzer LG-100 Series that has a unique built-in IRLAM (Infrared Laser Absorption Modulation) gas analysis technology. This product can take real-time measurements of partial pressure changes in the silicon tetrafluoride (SiF<sub>4</sub>) produced during some etching processes used in semiconductor manufacturing. These measurements



enable manufacturers to determine whether the etching has reached the target endpoint. The LG-100 can eliminate the risk of under-etching and over-etching, contributing to higher productivity and yield.

The LG-100 comes equipped with IRLAM, HORIBA’s unique infrared gas analysis technology developed in 2021, which realizes highly sensitive and fast (0.1 sec.) measurements of trace gases at a ppb level.

Kouji Imamura, head of the Development Division, explains, “More sophisticated sensing technologies are necessary for advanced logic semiconductors. The release of the LG-100 contributes to

greater productivity in manufacturing processes to produce these state-of-the-art semiconductors. Going forward, we will continue to respond to diverse customer needs by expanding products with built-in IRLAM technologies.”

HORIBA will also be highlighting another product introduced this year: The PD Xpation EX Reticle/Mask Particle Detection System, which builds upon the features of the PD Xpation, enhancing its ability to not only detect but also remove particles, all within a single, comprehensive system. HORIBA has also engineered a proprietary equipment front end module (EFEM) specifically designed to adapt the system for use with the overhead hoist transport (OHT) system found in semiconductor

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# SCREEN

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**HORIBA**

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manufacturing plants. The PD Xpation EX Reticle / Mask Particle Detection and Removal System drives greater efficiency and yield in semiconductor manufacturing processes.


Metrology Product Line Manager Kosuke Matsumoto explains, “Analysis, measurement, and control needs are becoming more sophisticated and diverse than ever

before in the semiconductor industry. We are working to further expand the functionality of the PD Xpation EX to create a single system that does everything from analyzing particle components to measuring the coating thickness of the pellicle.



HORIBA will continue to bring forth new possibilities in this way.”

Other products showcased at HORIBA’s Booth #1433 include a Raman Microscope, the LabRAM Odyssey,

a self-cleaning pH electrode, and the D700 pressure-based mass flow controller for gases. 

## SCREEN Focuses on Sustainability, New Coat/Develop Track Systems

SCREEN Semiconductor Solutions, Co., Ltd. (hereinafter “SCREEN”), exhibiting at SEMICON West Booth #1139 in South Hall, is a leading manufacturer of wafer processing equipment for the global semiconductor market. Products include:

- Single wafer & batch cleaning systems and scrubbers (SCREEN is the market leader in wafer cleaning systems).
- Coat/Develop tracks for all lithography and spin-on applications (SOC/SOG, etc.).
- Flash lamp and laser systems for annealing treatment
- Wafer inspection systems and metrology

“We respond to changing market needs with a diverse range of systems, from our flagship models for 300mm wafers, offering high functionality and superior productivity for the cutting-edge device market, to 200mm and under models that handle wafers of various sizes and shapes for the IoT device market,” said Dr. Harold Stokes Senior Manager and R&D Strategist at SCREEN SPE USA, LLC. “We are offering a diverse line-up of cleaning, coat/develop track, annealing, inspection, and metrology systems.”

At SEMICON West, SCREEN will be highlighting its sustainability efforts, along with newly introduced coat/develop track systems as well as flagship cleaning system. “In response to climate change, the SCREEN Group aims to contribute to the development of a sustainable society by reducing the environmental



The RF-300EX for 300mm wafers (left) and the RF-200EX, designed for 150 and 200mm wafers (right).

impact of all our business activities, including the development, manufacture, and sale of the technologies, products, and services it provides, as well as those of its customers,” Stokes said. “The SCREEN Group will strive to reduce GHG emissions through its business operations and achieve carbon neutrality by 2050.”

Progress to date has been impressive. In the fiscal year ended March 31, 2024, GHG

emissions (Scope 1 + Scope 2) from the company’s business activities were reduced by 45.3% (preliminary figures) compared to the fiscal year ended March 31, 2019, significantly exceeding the target (10% reduction) of Sustainable Value 2023, its mid-term plan through the fiscal year ending March 31, 2024.

SCREEN efforts to achieve a sustainability society include:

- **Participation in the Semiconductor Climate Consortium** As one of the founding members, SCREEN participated in the Semiconductor Climate Consortium established by SEMI. The company will continue to propose effective semiconductor ecosystem initiatives to address climate change issues.
- **Participation in imec SSTS** To reduce the environmental impact of the semiconductor industry, SCREEN participated in the new research program “SSTS” promoted by imec.



## SCREEN

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- **Introducing a visualization application into the Hikone Plant's Process Technology Center SCREEN** has introduced FTD solutions INC's Water Management Application (WMA) to visualize water management to accelerate sustainability development.
- **"zeroboard," a cloud service for calculating and visualizing CO<sub>2</sub> emissions** As an industry first, SCREEN has incorporated "zeroboard" into the semiconductor manufacturing equipment world. The company will continue to monitor CO<sub>2</sub> emissions for SCREEN products and services.

Sustainability efforts also include bringing greater energy efficiency to equipment operation and decreased use of chemical substances. With these factors in mind, SCREEN has successfully developed two new coat/develop track systems: the RF-200EX, designed for 150 and 200mm

wafers, and the RF-300EX for 300mm wafers. These systems inherit a wealth of advanced coat/develop track technologies refined by SCREEN over many years and deliver both outstanding productivity and a smaller footprint. They are also distinctly more environmentally friendly, dramatically reducing resist consumption during wafer coating and electricity consumption throughout the manufacturing process.

### Expansion of production and service system S<sup>3</sup> factory

Aiming to more swiftly and flexibly accommodate rapidly growing demand for semiconductor production equipment, in January 2024, SCREEN began operations at its new factory, S<sup>3</sup>-5. Along with the previously built S<sup>3</sup>-4 factory, the total productivity has

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Mr. Okamoto, the president of SCREEN

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## SCREEN

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been boosted by 40% (compared to 2022). It strengthens the production/sorting of parts and equipment/unit assembly of single-wafer cleaning equipment. An efficient production flow from start to shipment will be realized through connecting with S<sup>3</sup>-3 and S<sup>3</sup>-4.

“In addition to increasing our production capacity, the new factory’s operations have been designed to reduce environmental burden in a variety of ways, such as using renewable energy, reducing chemical and wastewater discharge, and using energy-efficient air conditioning systems,” Stokes said. “These efforts also extend to equipment development, as we constantly work to

provide more environmentally friendly equipment.”

Mr. Okamoto, the president of SCREEN Semiconductor Solutions, Co., Ltd., sums up the company’s initiatives, saying: “As we go forward, we will continue striving to contribute to society by delivering innovative, creative solutions to our customers through superior manufacturing. To this end, we are working to strengthen our R&D capabilities and further enhance communication with customers. I hope that you will take a look at what we are doing at SCREEN and let us know your thoughts. We provide leading-edge semiconductor equipment from Kyoto to the world.” 

## Wafer Fab Equipment: 2024 Revenue Holds Steady, Poised for 2025 Surge

*Yole Group announces a 2024 revenue (calendar year) to increase by 1.3% year-on-year, reaching \$108.1 billion, despite a 12% quarter-to-quarter drop in Q1 2024.*

### Global market evolution in 2024

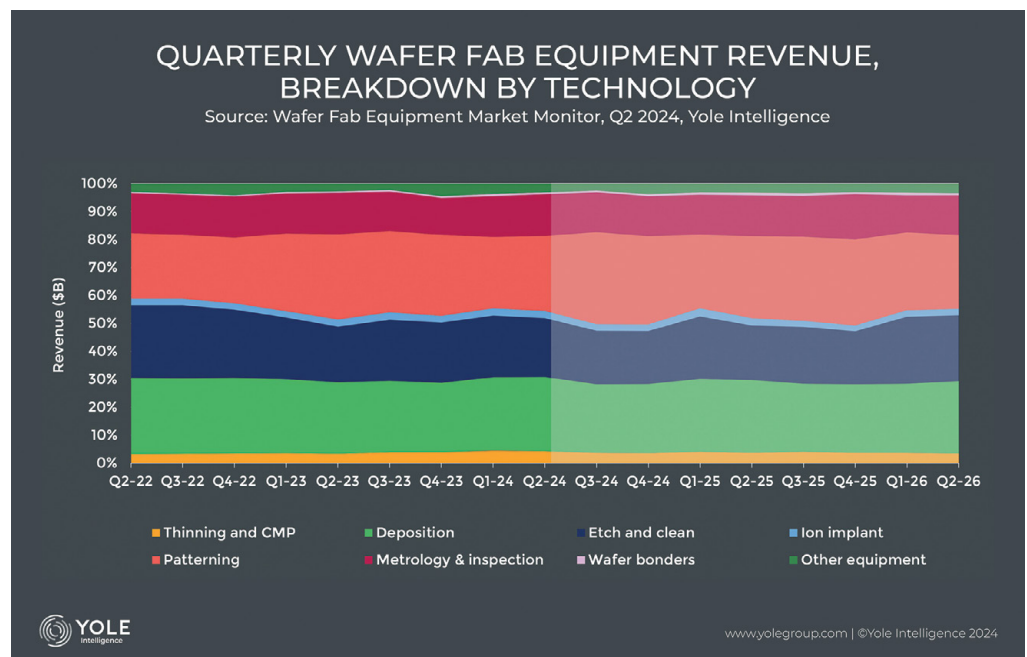
The 1.3% year-to-year growth is driven by increased spending on advanced logic, NAND, and DRAM memory, alongside robust investment in legacy nodes. Additionally, service and support revenue is expected to grow by 6% YoY to \$23.5 billion due to rising fab utilization rates globally. Over the long term, WFE revenue is anticipated to experience a CAGR of 4.3% from 2024 to 2029, reaching \$133.7 billion by 2029. Service and support revenue is also expected to grow, reaching \$27.6 billion in 2029, with a CAGR of 3.3% over the same period. This moderate growth follows significant increases in 2021-2022, driven by high demand for semiconductor devices.

WFE equipment vendors view 2024 as a transition year, with an expected increase in shipments in

2024 and 2025. Vendors are ramping up inventory to meet these needs and introducing new equipment solutions for upcoming process challenges. In Asia, especially in Greater China, there is ongoing IPO activity, while

global M&A activity remains stagnant.

In the 2<sup>nd</sup> half of 2024, WFE revenues are expected to rise. Q1 2024 saw a 12% QoQ (quarter-on-quarter) decline to \$25.2 billion. A slight



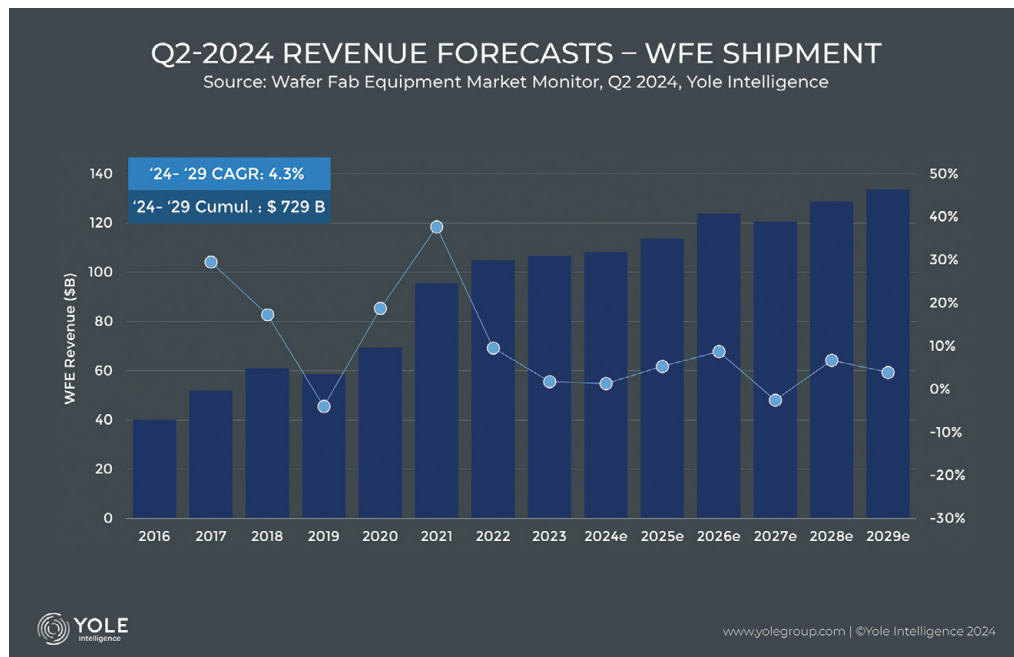


increase to \$25.3 billion is expected in Q2 2024, followed by more substantial growth in Q3 2024 and Q4 2024. Yole Group announces respectively, 9% and 8% QoQ).

### Overview by WFE market segment

The patterning WFE segment constituted 29% of the total WFE revenue in 2023, with ASML leading the market. Despite a 25% QoQ revenue decline in Q1 2024, the patterning segment is expected to maintain its market share in 2024.

The deposition WFE segment is projected to remain flat in 2024, with a modest 0.9% YoY increase, and is expected to recover to 2022 revenue levels by 2026.



In parallel, the etch and clean segment, which includes dry and wet

processes, experienced a significant revenue decline of

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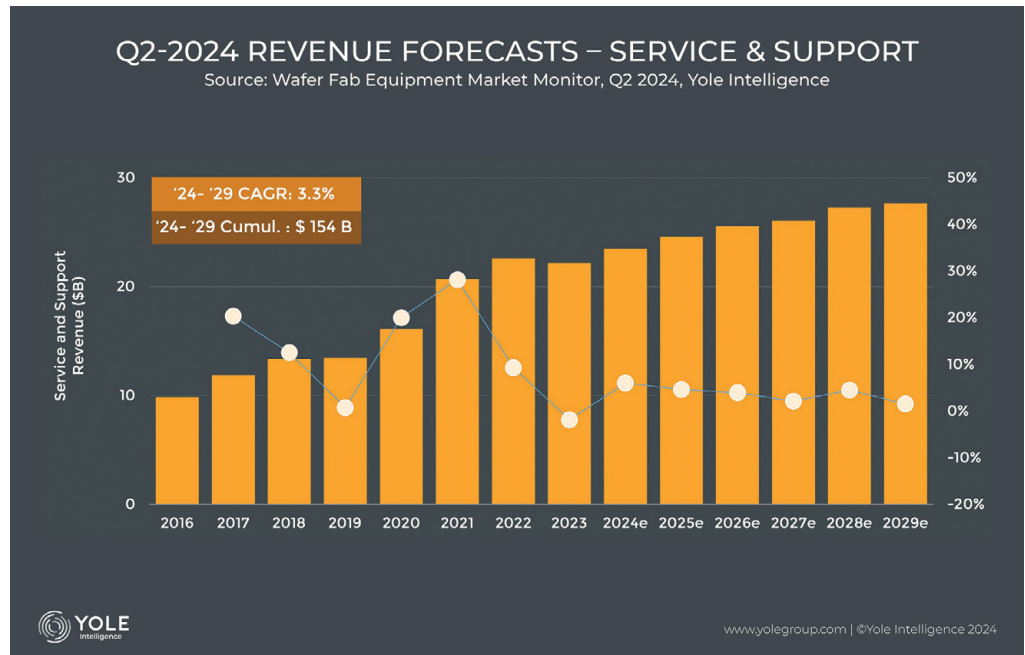
Featured Products

## WAFER

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16.7% YoY in 2023 due to reduced NAND CapEx. This segment is expected to see a sluggish recovery in 2024 but should improve in 2025 by 5% YoY and in 2026 by 27% YoY, explains Yole Group's analysts. The deposition and etch segments also saw declines in Q1 2024 by 7% and 8%, respectively.

The metrology and inspection WFE segment maintained its position in 2023 with only a 1% decline and is expected to grow by 4.1% YoY to \$15.7 billion in 2024. The segment's 3.7% revenue dip in Q1 2024 is anticipated to be offset in subsequent quarters. The ion implantation WFE market saw a reduction in market share, but the limited number of suppliers and favorable application mix should lead to revenue increases in both 2023 and 2024. The thinning and CMP (chemical mechanical planarization) segment is growing YoY, with quarterly variations linked to the fiscal years of major vendors in Japan and



the USA.

The “other equipment” segment, which includes fab automation, declined by 6% YoY in 2023 due to fab construction delays and lower utilization rates. This segment is expected to grow in 2024. The wafer bonder WFE segment increased by 13.8% YoY in 2023 and is projected

to grow by 26% YoY in 2024 due to the limited number of suppliers. Although wafer bonders represent only 1% of the total WFE revenue, they are crucial for fabricating multi-stacked CMOS image sensors, stacked NAND, and advanced logic devices using the Power Delivery Network. [SD](#)

## Bechtel: Now Is the Time for Digital Integration

Bechtel, a long-time leader in engineering, construction, and project management for things like nuclear reactors and liquefied natural gas facilities, made big news in the semiconductor industry in 2022 with the announcement that it would be the project delivery provider for Intel's greenfield fab campus project in Ohio.

“Intel has chosen Bechtel to deliver our largest construction project to date,” said Jackie Sturm corporate vice president, Global Supply Chain Operations at Intel. “Bechtel has decades of world class expertise in complex global construction projects, leveraging a deeply experienced team, critical craft support and robust analytics platforms. Their relentless focus on safety, quality and innovation aligns with Intel key values.”

Catherine Hunt Ryan, president of Bechtel's

Manufacturing & Technology business, said: “A project of this complexity and magnitude — with an outsized impact on the community and economy — is the type of work Bechtel is uniquely positioned to deliver. We are honored to be chosen by Intel as its partner and we are ready to build their most advanced semiconductor facilities in the world.”

Earlier in 2022, Bechtel announced its Manufacturing & Technology business unit to address growing customer and market demands for engineering, procurement, and construction services for semiconductor, electric vehicle, and data center sectors. Hunt Ryan is the president of the business, having previously served as Bechtel's CFO, and continues to serve on the company's Board of Directors.

Through this new business, Bechtel

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**Bechtel**

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provides engineering, procurement and construction, or EPC, services designed specifically for the semiconductor industry. The company conducts supply chain assessments, preliminary front-end engineering design (pre-FEED) studies, detailed engineering services, procurement, construction execution, and commissioning.

Bechtel also provides in-depth digital services. We recently caught up with Dr. Evann Smith, the digital solutions manager for Bechtel's Manufacturing & Technology business unit where they lead the strategic development and deployment of the digital ecosystem "that is inclusive of our data architecture, our data engineering, our data integration, and our analytics and data science, including AI and machine learning," they said.

Smith said Bechtel is currently working with a semiconductor customer to develop their next evolution of digital integration for project engineering and construction. "We are helping them build out their digital solutions framework,

their environment and their integrations, so that they can best leverage all of the data that is generated throughout project execution and into operations," Smith said. "That is part of the value-add that we bring to the

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semiconductor industry. We're building digital capabilities, workflows and integrations to establish the foundation for digital design for the next decade plus."

Smith said digital integration and data intelligence is particularly critical in the semiconductor industry now, more so than ever before. "It has to do with the scale and the complexity of the projects that we're seeing come online and that we're working on right now," they said, noting that over \$100 billion in construction spending is forecasted to occur over the next five years. "It's not just more and more projects and more

and more money; each of these projects is becoming increasingly bigger and more complex. I would argue that the increasing scale and complexity of these projects is fundamentally driving the imperative of digital integration. We need consistent, integrated, real time and transparent execution of these projects for our EPCs and for our owner operators," Smith said.

Smith said there's an incredible opportunity for repeatability in fab construction. "The goal would be that — if you have that digitally integrated environment and data transparency

— to carry that intelligence from mod to mod to mod." Smith expects it could result in time schedule and efficiency gains similar to what Bechtel has experienced in the liquefied natural gas industry (where we've seen gains approaching 40%).

At SEMICON West this year, Smith will be a panelist on the CXO Panel "Can AI/GenAI + Digital Twin Make Semiconductor Factory Construction Smarter?", to be held Wednesday from 1:00-2:00pm on the Smart Manufacturing Pavilion Stage in the North Hall. 

## Busch Group Companies Announce Joint Presence at Semicon West

The three companies of the Busch Group (Busch Vacuum Solutions, Pfeiffer Vacuum and centrotherm clean solutions) announce their joint presence at Semicon West 2024. This marks a significant milestone, as it will be the inaugural occasion that the Busch Group exhibits collectively in one booth (#733) in the US.

Visitors of the Busch Group booth can expect an impressive showcase of vacuum technology and gas abatement systems designed for supporting semiconductor fabs and sub-fabs. The in-booth messaging is "Ultimate Product Range" and "Total Fab Solutions." Turgay Ozan, President and General Manager Busch Vacuum Solutions & Pfeiffer Vacuum, comments: "We're uniquely positioned to be the premier full-solutions partner to the semiconductor industry. Our extensive product range supports everything from the clean room to the sub-fab. The range covers gas abatement systems, vacuum pumps, contamination management, leak detection, valves, sub-fab management, and service for all brands."

### Range of vacuum and abatement solutions

**ASM 392 mobile leak detector:** With its integrated



Magnetically levitated turbopumps from Pfeiffer Vacuum

turbomolecular vacuum pump, the ASM 392 from Pfeiffer Vacuum is SEMI S2 compliant and optimized for rapid pump downs and short response times on large test objects. Its dry, frictionless backing pump and a powerful high vacuum pump make it ideal for testing in clean room environments.

**Series E electric valves:** Being unveiled at the show for the first time, Pfeiffer Vacuum's Series E is a groundbreaking electric angle valve line designed for easy integration into high vacuum applications. Combining advanced electric actuation with energy efficiency, Series E offers superior control, reliability, and cost

savings.

**ATH 2804 M turbopump:** With a compact footprint, Pfeiffer Vacuum's ATH 2804 M magnetically levitated turbomolecular vacuum pumps provide high gas throughput and are ideal for semiconductor manufacturing processes.

**HiPace 3400 IT turbopump:** The HiPace 3400 IT, designed exclusively for demanding ion implantation applications, sets the standard as the most compact turbopump in its class. The DN 320 flange size increases the pumping speed for process gases by

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up to an impressive 30%. Its unique bearing concept and specially coated rotor design protect both the process and the pump, providing unparalleled durability and reliability.

**TORRI BD 0100/0600 dry pumps:** TORRI BD from Busch Vacuum Solutions offer short pump down times for load lock chambers and are among the smallest, lightest and most energy-efficient dry multi-stage rotary lobe vacuum pumps on the market.

**CT-TW-H thermal abatement:** The high-temperature

thermal abatement system from centrotherm clean solutions combines the wide process coverage of flame abatement with the fuel-free aspects of plasma abatement, with lower operating costs and secondary emissions. Able to destroy the molecular process gas  $\text{NF}_3$  at class-leading levels with extremely low  $\text{NO}_x$  emissions, the CT-TW-H finally delivers a sustainable solution with a minimal carbon footprint to the CVD and metal-etch process family. 

## SEMI and Semiconductor Digest Announce 2024 Best of West Award Finalists

**SEMICON® WEST**

SEMI and Semiconductor Digest today announced finalists for the Best of West award to be presented at SEMICON West 2024, July 9-11 at the Moscone Center in San Francisco. The Best of West Award winner will be announced at SEMICON West 2024 on Thursday, July 11 at 11:00 a.m. PDT in the Media Hub

Presented by SEMI Americas and Semiconductor Digest each year, the Best of West award recognizes innovative new products or services that are significantly advancing the electronics manufacturing supply chain or a particular manufacturing capability.

The following Best of West 2024 finalists will showcase their products on the SEMICON West 2024 show floor:

- **Advantest: HA1200 die-level handler – Booth 1039** The new HA1200 die-level handler for the Advantest V93000 system-on-chip (SoC) tester offers die test capability with active thermal control to enable at-speed 100% test coverage before the die are assembled into 2.5D/3D packages, thus ensuring minimal loss of die yield at final test.
- **EV Group: EVG®880 LayerRelease – Booth 1345** The EVG®880

LayerRelease™ system is the first HVM equipment platform incorporating EVG's innovative LayerRelease™ technology. It enables nanometer-precision release of bonded, deposited or grown layers from silicon carrier substrates using an IR laser coupled with specially formulated inorganic release materials. As a result, it eliminates the need for glass carriers.

- **Nordson TEST & INSPECTION: SpinSAM Acoustic Microscopic Imaging (AMI) System – Booth 1233** The latest product from Nordson TEST & INSPECTION is an automated inspection tool that delivers high throughput and better sensitivity for accurately locating defects in wafer-based assemblies. SpinSAM provides superior image quality and defect capture. Successful applications include bonded wafers, Chip-on-Wafer, stacked wafers, MEMS, over-molded wafers and more.

### About Semiconductor Digest

Through a mix of news, contributed articles and staff-written articles, Semiconductor Digest ([www.semiconductor-digest.com](http://www.semiconductor-digest.com)), is dedicated to providing global information about the design, manufacturing, packaging

and testing of semiconductors and other types of electronic devices, including MEMs, LEDs, displays, power electronics, optoelectronics/ photonics, biomedical devices, solar cells, thin filmbatteries and flexible electronics. Semiconductor Digest consists of a website, magazine and topic-focused newsletters.

### About SEMI

SEMI® is the global industry association connecting over 3,000 member companies and 1.5 million professionals worldwide across the semiconductor and electronics design and manufacturing supply chain. We accelerate member collaboration on solutions to top industry challenges through Advocacy, Workforce Development, Sustainability, Supply Chain Management and other programs. Our SEMICON® expositions and events, technology communities, standards and market intelligence help advance our members' business growth and innovations in design, devices, equipment, materials, services and software, enabling smarter, faster, more secure electronics. Visit [www.semi.org](http://www.semi.org), contact a regional office, and connect with SEMI on LinkedIn and X to learn more. 