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PRESENTATION

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

(spoken in foreign language) Good afternoon, everyone, and welcome to TSMC's second-quarter 2024 earnings conference and conference call. This is Jeff Su, TSMC's Director of Investor Relations, and your host for today.

Today's event is being webcast live through TSMC's website at www.tsmc.com, where you can also download the earnings release materials. (Operator Instructions) The format for today's event will be as follows. First, TSMC's Senior Vice President and CFO, Mr. Wendell Huang, will summarize our operations in the second quarter 2024, followed by our guidance for the third quarter 2024. Afterwards, Mr. Huang and TSMC's Chairman and CEO, Dr. C.C. Wei, will join me and provide the company's key messages. Then, we will open both the floor and the line for the Q&A session.

As usual, I'd like to remind everybody that today's discussions may contain forward-looking statements that are subject to significant risks and uncertainties, which could cause actual results to differ materially from those contained in the forward-looking statements. Please refer to the Safe Harbor notice that appears in our press release. And now, I would like to turn the microphone over to TSMC's CFO, Mr. Wendell Huang, for the summary of operations and the current quarter guidance.

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

Thank you, Jeff. Good afternoon, everyone. Thank you for joining us today. My presentation will start with the financial highlights for the second quarter of 2024. After that, I will provide the guidance for the third quarter 2024.

Second-quarter revenue increased 13.6% sequentially in TWD or 10.3% in US dollars, as our business was supported by strong demand for our industry-leading 3- and 5-nanometers technologies, partially offset by the continued smartphone seasonality. Gross margin increased 10 basis points sequentially to 53.2%, mainly reflecting cost improvement and a more favorable foreign exchange rate, partially offset by the margin dilution from N3 ramp.

Due to the operating leverage, total operating expense accounted for 10.5% of net revenue, as compared to 11.1% in the first quarter. Thus, operating margin increased 0.5 percentage point sequentially to 42.5%. Overall, our second quarter EPS was TWD9.56 and ROE was 26.7%.

Now, let's move on to revenue by technology. 3-nanometer process technology contributed 15% of wafer revenue in the second quarter, while 5-nanometer and 7-nanometer accounted for 35% and 17% respectively. Advanced technology, defined as 7-nanometer and below, accounted for 67% of wafer revenue.

Moving on to revenue contribution by platform, HPC increased 28% quarter over quarter to account for 52% of our second-quarter revenue, surpassing 50% for the first time. Smartphone decreased 1% to account for 33%. IoT increased 6% to account for 6%. Automotive increased 5% to account for 5%. And DCE increased 20% to account for 2%.

Moving onto the balance sheet, we ended the second quarter with cash and marketable securities of TWD2 trillion or USD63 billion. On the liability side, current liabilities increased by TWD23 billion, mainly due to the increase of TWD16 billion in accounts payable. Long-term interest-bearing debt increased by TWD9 billion, mainly as we raised TWD12 billion in corporate bonds.

On financial ratios, accounts receivable turnover days decreased by 3 days to 28 days. Days of inventory decreased by 7 days to 83 days primarily due to higher N3 wafer shipment.

Regarding cash flow and CapEx, during the second quarter, we generated about TWD378 billion in cash from operations, spent TWD206 billion in CapEx, and distributed TWD91 billion for third quarter '23 cash dividend. Overall, our cash balance increased TWD101 billion to TWD1.8 trillion at the end of the quarter. In US dollar terms, our second-quarter capital expenditures totaled USD6.36 billion.

I've finished my financial summary. Now, let's turn to our current quarter guidance. Based on the current business outlook, we expect our third-quarter revenue to be between USD22.4 billion and USD23.2 billion, which represents a 9.5% sequential increase or 32% year-over-year increase at the midpoint.

Based on the exchange rate assumption of USD1 to TWD32.5, gross margin is expected to be between 53.5% and 55.5%, operating margin between 42.5% and 44.5%. This concludes my financial presentations.

Now, let me turn to our key messages. I will start by talking about our second quarter '24 and third quarter '24 profitability. Our second-quarter gross margin was 53.2%, slightly ahead of the high end of our guidance, mainly as we saw a higher-than-expected overall capacity utilization rate as compared to our forecast three months ago.

We have just guided our third-quarter gross margin to increase by 1.3 percentage points to 54.5% at the midpoint. This is primarily due to the higher overall capacity utilization rate in the third quarter and better cost improvement effort, including productivity gains, partially offset by continued dilution from N3 ramp-up, N5 to N3 tool conversion costs, and higher electricity prices in Taiwan. Excluding the impact of foreign exchange rate, of which we have no control over, and factoring in the margin impact from our global manufacturing footprint expansion plans, we continue to forecast a long-term gross margin of 53% and higher is achievable.

Next, let me talk about our 2024 capital budget. Every year, our CapEx is spent in anticipation of the growth that will follow in the future years. And our CapEx and capacity planning is always based on the long-term market demand profile. As the strong, structural AI-related demand continues, we continue to invest to support our customers' growth. We are narrowing the range of our 2024 capital budget to be between USD30 billion and USD32 billion as compared to USD28 billion to USD32 billion previously. Between 70% and 80% of the capital budget will be allocated for advanced process technologies. About 10% to 20% will be spent for specialty technologies and about 10% will be spent for advanced packaging testing, mask-making, and others. At TSMC, a higher level of capital expenditures is always correlated with the higher growth opportunities in the following years. Now, let me turn the microphone over to C.C.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Thank you, Wendell. Good afternoon, everyone. First, let me start with our near-term demand outlook. We concluded our second quarter with revenue of USD20.8 billion, above our guidance in US dollar terms. Our business in the second quarter was supported by strong demand for our industry-leading 3-nanometer and 5-nanometer technologies, partially offset by continuous smartphone seasonality.

Moving into third quarter 2024, we expect our business to be supported by strong smartphone and AI-related demand for our leading-edge process technologies. Looking at the full year of 2024, we forecast the overall semiconductor market excluding memory to increase by about 10%, which is unchanged from our forecast three months ago.

At this time, we would like to expand our original definition of foundry industry to Foundry 2.0, which also includes packaging, testing, mask-making, and others, and all IDM excluding memory manufacturing. We believe this new definition better reflects TSMC's expanding addressable market opportunities in the future. However, I want to emphasize here that TSMC will only focus on the most advanced back-end technologies, which help our customers in leading-edge products.

Under this new definition, the size of the foundry industry was close to USD250 billion in 2023 as compared to USD115 billion under the previous definition. With our new definition, we forecast foundry industry growth to be close to 10% year over year in 2024.

TSMC's share of the foundry industry under our new definition was 28% in 2023. Supported by our strong technology leadership and broader customer base, we expect this to further increase in 2024.

Over the past three months, we have observed strong AI and high-end smartphone-related demand from our customers as compared to three months ago, leading to increasing overall capacity utilization rate for our leading-edge 3-nanometer and 5-nanometer process technologies in the second half of 2024. Thus, we continue to expect 2024 to be a strong growth year for TSMC. We are raising our full-year guidance and now expect our 2024 revenue to increase slightly above mid-20s percent in US dollar term.

Next, I will talk about TSMC's capacity planning process and investment discipline. This is important, especially when we have such high forecasted demand from AI-related business.

TSMC's mission is to be the trusted technology and capacity provider for the global logic IC industry for years to come. The continued surge in AI-related demand supports our strong structural demand for energy-efficient computing. As a key enabler of AI applications, the value of our technology position is increasing as customers have relied on TSMC to provide the most advanced process and packaging technology at scale in the most efficient and cost-effective manner.

As such, TSMC employs a disciplined framework to address the structural increase in the long-term market demand profile underpinned by the industry megatrend of AI, HPC, and 5G. We work closely with our customers to plan our capacity. We also have a rigorous and robust system that evaluates and judges market demand from both a top-down and bottom-up approach to determine the appropriate capacity to build. Our capital investment decisions are based on four disciplines. That is technology leadership, flexible and responsive manufacturing, retaining customers' trust, and earning a sustainable and healthy return.

To ensure a proper return from our investment, both pricing and cost are important. TSMC's pricing strategy is strategic, not opportunistic, to reflect the value that we provide. Today, we are investing heavily in leading-edge specialty and advanced packaging technologies to support our customers' growth and enable their success. If customers do well, TSMC should do well.

For example, we are happy to see many of our customers' structural profitability improving in these past few years. At the same time, we face rising cost challenges due to increasing process complexity in leading node, higher electricity costs in Taiwan, global fab expansion in higher-cost regions, and other cost inflation challenges.

Therefore, we'll continue to work closely with our customer to sell our value. We will also work diligently with our suppliers to deliver on cost performance. We believe such actions will help TSMC earn a sustainable and healthy return so that we can continue to invest in technology and capacity to support our customers growth and fulfill our mission as a trusted foundry partner while delivering profitable growth for our shareholders.

Finally, I will talk about our N2 status and A16 introduction. Our 2-nanometer and A16 technologies, these are industry in addressing the insatiable need for energy-efficient computing and almost all the AI innovators are working with TSMC. We expect the number of the new tape-outs for 2-nanometer technologies in its first two years to be higher than both 3-nanometer and 5-nanometer in their first two years.

N2 will deliver full node performance and power benefit, with 10% to 15% speed improvement at the same power, or 25% to 30% power improvement at the same speed, and more than 15% chip density increase as compared with N3E. N2 technology development is progressing well, with device performance and yield on track, all ahead of plan. N2 is on track for volume production in 2025 with a ramp profile similar to N3

With our strategy of continuous enhancement, we also introduced N2P as an extension of our N2 family. N2P features a further 5% performance with -- at the same power of 5% to 10% power benefit at the same speed on top of the N2. N2P will support both smartphone and HPC applications, and volume production is scheduled for the second half 2026.

We also introduced A16 as our next nanosheet-based technology, featuring Super Power Rail, or SPR, as a separate offering. TSMC's SPR is innovative, best-in-class backside power delivery solution that is the first in the industry to incorporate a novel backside contact scheme to preserve gate density and device with flexibility. Compared with N2P, A16 provides a further 8% to 10% speed improvement at the same power, or 15% to 20% power improvement at the same speed, and additional 7% to 10% chip density gain

A16 is best suited for specific HPC product with complex signal route and dense power delivery network. Volume production is scheduled for second half 2026. We believe N2, N2P, A16 and its derivatives will further extend our technology leadership position and enable TSMC to capture the growth opportunities well into the future. This concludes our key messages, and thank you for your attention.

QUESTIONS AND ANSWERS

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

(Event Instructions) Gokul Hariharan, JPMorgan.

Gokul Hariharan - *JPMorgan - Analyst*

Thanks, Jeff. Good afternoon, C.C. and good afternoon, Wendell. Thanks for giving us the picture in terms of how you are planning future capacity. Just on AI accelerator and related capacity, both front-end and advanced packaging, clearly, every customer is queuing up at TSMC for capacity. I think, last time, we talked about this maybe a couple of quarters back, C.C., you mentioned we expect to see supply to kind of reach balance -- supply, demand to reach balance by end of this year. Just wanted to see, what is your current remark? How do you think about supply, demand balance for AI accelerator and CoWoS advanced packaging capacity?

And I think, in your symposium, you talked about 60% CAGR compounded growth for CoWoS capacity in the next four, five years. So could you talk a little bit about how much capacity for CoWoS would you be planning to build next year as well? Like last year, you said you're going to be doubling the capacity this year. Now that we are in the middle of this year, maybe can we get a view on what is the capacity expansion for next year? That's my first question, thank you.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, Gokul. All right, for the benefit of the audience online and in person, please allow me to kind of try to summarize your question. So Gokul's question, first of all, he understands and appreciates TSMC's disciplined framework in terms of looking at how to build capacity. His question is that, it seems that everyone today, AI accelerators and advanced packaging, is queuing at TSMC to ask for capacity. So his question is when do we, C.C., expect supply, demand to reach a balance, both for the accelerator side. And then, for the CoWoS, at the symposium, we said CoWoS' capacity will grow at a 60% CAGR the next few years. He also wants to know what are we planning to build or increase for 2025 CoWoS.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Gokul, I also tried to reach the supply and demand balance, but I cannot today. The demand is so high. I had to work very hard to meet my customers' demand. We continue to increase. I hope, sometime in 2025 or 2026, I could reach the balance.

Talking about CAGR of those kind of increase of the CoWoS capacity, now, it's out of my mind. We continue to increase whatever, wherever, whenever I can, okay. The supply continue to be very tight, all the way to probably 2025, and I hope it can be eased in 2026. That's today's situation.

Gokul Hariharan - *JPMorgan - Analyst*

Any thoughts on next year capacity? Like, are you going to double your capacity again next year for CoWoS?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

The last time I say that, this year, I doubled, right? More than double, okay. So next year, if I say double, probably, I will answer your question again. Next year, it's more than double. We're working very hard, as I said, wherever we can, whenever we can.

Gokul Hariharan - *JPMorgan - Analyst*

Okay, thank you. My second question is regarding gross margins. I think, second-half guidance already seems to be better than what originally we were thinking, that gross margin could drop in second half, but looks like it's actually going up. And looks like a lot of the headwinds on gross margin is coming in this year, so how should we think about gross margin looking forward for TSMC? Are we going to get back to the high 50%, 60% gross margin that we saw in 2022, given that you've got -- you're selling more of your value, you have some of the N3 tailwinds in terms of yield improvement coming through?

Into that, I will also ask, how should we think about impact of subsidies and ITC credits as you start ramping your overseas locations? How does that impact cost and gross margin? Because there's also some subsidies coming in and currently TSMC's mostly talking about gross CapEx and gross spend.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay. So let me summarize Gokul's second question. It's around gross margin and profitability. He notes second half '24 gross margin seems to be better than the expectation. So his question is, really, how should we think about gross margin in the next several years? He notes, as we said, we will sell our value and that dilution of N3 will gradually reduce. So where can the gross margins go back to a high 50% or 60%, that kind of level that we saw a few years ago in 2022? Maybe that's the first part of his second question. I'll stop here and I'll get to the second.

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

Sure. Gokul, let me share with you some of the puts and takes. On gross margin, 2025 and a little bit beyond that, you already talked – there are positives and negatives, you already mentioned positive will be a decreasing dilution from N3, we're selling our value, and we continue to drive down our cost, increase the productivity. That is -- we are very good at that.

On the other hand, let's use N5 conversion to N3 as an example. We are not ruling out the possibility of further converting more N5 to N3 because we're seeing very strong demand for N3. If we decide to do that, of course, there will be a negative impact on the year that we do that. But in the future years, that will be beneficial.

We continue to face cost challenges, inflation cost challenges, including electricity prices, et cetera. And also, we are beginning the production of our overseas fab, two overseas fabs next year. The phase one of Arizona fab and phase one of the Kumamoto fab. We expect that the overseas fabs will dilute our gross margins by between two to three percentage points next year and in the next several years.

So those are the puts and takes to give you the concept. However, we've taken all that into considerations with our efforts in managing the cost gap, especially between the overseas fab in Taiwan. We're repeating and confident to say that 53% and higher gross margin is achievable. So I think that's the first part of your question.

Gokul Hariharan - *JPMorgan - Analyst*

Yeah, that's right.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

And then maybe, also, just Gokul asked if it's possible to get back to the high 50%, 60% level that we saw in 2022?

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

Yeah, if we have a very high utilization rate, everything else stays the same, possible.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay. And then the second part of his question was, what is the impact from the different government incentives, including the CHIPS Act, ITC credits in the US, et cetera, to the financials and also, I think, partly gross CapEx and net CapEx.

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

Generally speaking, when subsidies are received, then you see that on the cash-flow statement. They will be used to offset the asset value. That will be on the balance sheet. When this fab begins to production, the P&L impact will come in. So generally speaking, it's like that.

Different government has different approach in providing the grants, so that's a different story. But you can look at our financial statements, there will be actual subsidy received in the period of previous quarter and previous year. For example, 2023, we received a total subsidies of slightly higher than USD1.5 billion equivalent. And we received that mainly in Japan.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, all right. Great. Thank you. Let's move on. We'll take our next one from Charlie Chan from Morgan Stanley and then we'll go to Bruce Lu from Goldman.

Charlie Chan - *Morgan Stanley Asia Ltd. - Analyst*

Hi, C.C., Wendell, and Jeff. Great to see you in person again. So my first question is really about your progress of selling the value. I'm not sure what's the progress. And do you think, for next year, your leading-edge capacity is going to be shortage? If that's the case, whether that increases your chance to sell more value to your customers? Thank you.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, so Charlie's first question is around pricing and he wants to understand the progress of, I guess, selling our value. And also, in next year, looking at next year, particularly for the leading-edge nodes, do we expect that in terms of the demand to be very full?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Charlie, this kind of pricing strategy is very strategic. You are asking me about the status; so far, so good. And this is an ongoing and continuous process. We are continuing to share our value. And by the way, my customers are doing very well also. You knew that. So we should do well also.

Charlie Chan - *Morgan Stanley Asia Ltd. - Analyst*

That is actually my follow-up question on this first question. For different segment, for example, HPC customers are doing very, very well. But for smartphone customers, probably more sensitive to the cost. Do you expect the kind of difference of kind of value increase for different customers even at a same node?

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

So Charlie is asking, how will we do the pricing? Will it be different between, for example, an HPC customer versus a smartphone customer at the same node? And also, his question earlier was, do we expect the demand for the leading nodes to be very high next year?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Since pricing is strategic, so it won't be flat for every product sector. So it will be different. That's all I can share with you. And all my customers, they are looking for leading-edge capacity for next few years, and we are working with them. And so far, we try our best to support them, both in pricing and in capacity.

Charlie Chan - *Morgan Stanley Asia Ltd. - Analyst*

Thank you. And second topic is, definitely, over the past two days, there is a geopolitical risk. So Mr. Donald Trump talked about maybe a few years ago, Taiwan/TSMC took 100% chip business from US. So congrats on that part, very high market share.

However, the concern is growing. The US continue to depend on our island, TSMC, and the chip production. So our question is for shareholders, how TSMC is going to mitigate this potential geopolitical risk. For example, whether you are going to further expand your US capacity or even share the ownership with the US government? And maybe a technical question to Wendell, for today, if we are shipping chip to the US customers, do we need to pay for the US tariff?

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, sorry. So, Charlie's second question is around sort of overseas expansion and geopolitical risk. He notes the comments from former President Trump a few days ago that Taiwan Semiconductor has taken 100% of the business. So his question is, really, how does TSMC plan to mitigate the geopolitical risk? Does this include expanding capacity overseas, particularly in the US? Would we consider -- I think part of his question was some JV or joint investments, whether with government or whether with partners. And the last question, I think, was more for Wendell about the tax or the tariffs, so to speak.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Okay, Charlie, so far, we did not change any of our original plan of expansion of our oversea fab. We continue to expand in Arizona, in Kumamoto, and maybe future in Europe. No change to our strategy. We continue our current practice. You mentioned about the JV, no. Okay.

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

On the tariff, not that we know of. Normally, if there's an import tariff, the customers will be responsible for that. But no discussion, nothing.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay. Thank you, Charlie. All right. We'll take the next question from Bruce Lu from Goldman Sachs in the front, then we'll move online.

Bruce Lu - *Goldman Sachs L.L.C. - Analyst*

Thank you for taking my question. My question is that, why don't we take up our gross margin or structure profitability target? I mean, TSMC has been saying for selling your value for past couple of quarters without changing the margin target, i.e., most likely you are passing through all the costs. But please, I do recall in 2021, I mean, TSMC do raise the gross margin target by then because to support the future growth with more R&D.

As the technology continue to be enhanced and more difficult, and one of your customer, and this is supportive that to suggest that you should charge even more. So my question is that, why is that you don't raise your gross margin target when you are trying to sell your value, which we believe we deserve much higher value.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay. So thank you, Bruce. So Bruce's first question is about profitability and value. Bruce seems to agree that TSMC is providing value to our customers. He also notes in 2021, indeed, a few years ago, our gross margin target, long-term gross margin target, was about 50%, and we're able to increase that to 53% and higher.

So his question is, really, with everything that is going on today, with the value of our technology enabling our customers more and more, why doesn't TSMC increase or revise up our long-term gross margin target from the current 53% and higher? Is that the essence?

Bruce Lu - *Goldman Sachs L.L.C. - Analyst*

Zheng Lu

Yeah.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Bruce, thank you for recognizing TSMC's value. I'm working with our customers. As I said, this kind of pricing is strategic. And certainly, we want to sell our value. Changing the target at this moment, I think I would like to emphasize 53% and higher. Please put more attention to "and higher."

The number, I'm not going to change it at this time. When I have more conversation with my customers and discuss with them, I probably will give you "and higher" portion, okay? Thank you.

Bruce Lu - *Goldman Sachs L.L.C. - Analyst*

Thank you. My next question is for advanced packaging. So management used to mention that advanced packaging margin was lower than the corporate average, but with higher ROEs. But given the recent progress for the CoWoS and everything, do we see a much better profitability for the CoWoS? And given that it's so difficult to expand the capacity, are you planning to work with more partners to increase your CoWoS supply, which will solve your current supply and demand issues?

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay. Thank you, Bruce. So Bruce's second question is around advanced packaging. Part of it is in terms of the profitability. He notes, we used to say, which is true, is lower than the corporate average profitability but can earn a similar return or ROE. But his question is now, with more and more CoWoS demand and greater scale, is the profitability of advanced packaging, I think, approaching or at or above the corporate average? And also, given the tight supply, would we consider to work with more partners to help increase the capacity for CoWoS to support our customers' growth?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

You are right. For advanced packaging, the gross margin used to be much lower than the corporate average. Now, it's approaching corporate average. We are improving it. That's because of scale of the economics and we put a lot of effort to reduce our cost. So gross margin is greatly improving in these two years.

As for the working with OSAT partners, yes, we are doing it because of -- I just answered the question whether the CoWoS capacity is enough or not? It's not enough and in great shortage, and that will limit my customers' growth. So we are working with our OSAT partners and trying to give more capacity to my customers so that they can grow healthily. And so the TSMC's wafers can be sold healthily, okay.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay. Thank you, C. C. Thank you, Bruce. Operator, can we move to the first participant online for their -- his or her questions, please?

Operator

Brett Simpson, Arete.

Brett Simpson - *Arete Research Services LLP - Analyst*

Yeah, thanks very much. My question was really about your capacity plans for the next nodes at N2, including A16. We're hearing that AI chipmakers are looking to migrate more aggressively from N-1 to the leading edge, particularly due to backside power because they're trying to lower their

power budgets going forward. So my question, can you support this move? And if so, should we be expecting N2, A16 to be structurally a much bigger node than we've seen in the past few nodes? Thank you.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, Brett, thank you. So Brett's first question is on capacity planning, particularly at the leading-edge N2 and A16. So he notes rightly that AI customers are migrating aggressively from N-1 in the past to the most leading node. He notes particularly A16 driven by the interest in backside power. So his question is, can we support this move in terms of capacity to support the customers, and also, whether thus N2 and A16 will be a much bigger node than our nodes in the past?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Brett, you are right. All the people want to move into kind of a power-efficient mode. And so they are looking for the more advanced technology so that they can save power consumption. And so a lot of my customers want to move into N2, N2P, A16 quickly.

We are working very hard to build the capacity to support them. Today, it's a little bit tight. Not a little bit, actually; today is very tight. I hope in next year or the next two years, we can build enough capacity to support this kind of demand. Today, yes, we are working hard to support them. And enough? Not yet, but we are working hard to get it.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Does that answer your first question, Brett?

Brett Simpson - *Arete Research Services LLP - Analyst*

Okay, thank you. Yes, that's great, Jeff. Thank you, C.C. Wei. My follow-up question was for Wendell. I wanted to just dig into the gross margin dilution from N3. Where is that at today? And does the introduction of N3E structurally improve your N3 returns? I guess N3 is less capital-intensive. There's less EUV layers, so I'm keen to understand that this drives better economics for TSMC, particularly as you start to ramp more N3 capacity in the second half of this year? Thank you.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

All right. Thanks, Brett. So Brett's second question is on the gross margin dilution from N3. He notes that N3E uses less EUV layers, less capital intensity. So his question is, as we ramp N3 more and more, does N3E structurally improve the returns in gross margin of N3 as a whole.

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

Okay, Brett, we don't break it down between the different nodes within the family. But I can share with you, overall speaking, as we said before, N3 takes a longer while to reach the corporate margin. In the past, it was about 8 to 10 quarters. For N3, we're looking at 10 to maybe 12 quarters. But it is improving and we expect it to continue to improve.

Brett Simpson - *Arete Research Services LLP - Analyst*

Thank you, Brett.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, thank you, Brett. Operator, let's take the next set of questions from the next participant on the call, please.

Operator

Charles Shi, Needham.

Charles Shi - *Needham & Company Inc. - Analyst*

Hi, thanks for taking my questions. Maybe a first one, just want to follow up. Wendell, I think I heard you talking about that potentially more N3 conversion, maybe beyond what you're trying to do right now, the conversion. I just want to understand the overall philosophy here because I think, in the past, the TSMC does do this node-to-node conversion quite actively. Let's say, 10-nanometer to 7-nanometer, and probably, even earlier, 20-nanometer to 16-nanometer.

And I think you told us basically treat 10 and 7 as one large node, 20 and 16 as one large node. Should we start to really think about maybe 5 and 3 are just one big node and maybe more conversion -- we should think about more of the N3 capacity growth will come from conversion going forward less from the greenfield investment? That's the first question.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, Charles. So Charles' first question is, really, look at our conversion strategy. He notes that we have always talked about building in tool commonality to provide us flexibility. We have done so in the past at certain nodes like 20 and 16, 10 and 7. So his question is, really, we have said that we potentially convert more N5 tools to support the strong demand for N3 capacity. So his question is should we, investors, analysts start to think about N5 and N3 as one big node?

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

Right, you mentioned about [20] (corrected by company after the call) and 16, they are a big family. 7 and 10 are a big family. But 5 and 3 are not a big family in our definitions. At the same time, the node-to-node tool commonality in TSMC is pretty high. So for 5 and 3, the commonality of tools is over 90%, and these two nodes are adjacent. They're all in Tainan Science Park. And so it's very easy to do the conversions. Did I answer your questions?

Charles Shi - *Needham & Company Inc. - Analyst*

Yes. May I ask a second question?

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Certainly.

Charles Shi - *Needham & Company Inc. - Analyst*

Thanks, maybe a question about CoWoS. I think I heard -- C. C., you said maybe -- there's some technical difficulty on my side. I just want to clarify. Maybe you may double the CoWoS capacity again in 2025. But a little bit more technical question, I do want to better understand the technology constraints because your customers seem to be migrating from CoWoS-S to the more advanced version CoWoS-L, CoWoS-R and we learned that CoWoS-L, -R does not require TSV, does not require a large silicon interposer. Does that help, at least to some degree, the capacity constraints

you're facing on overall CoWoS? And does that help to maybe to achieve that goal of maybe getting to the supply, demand balance some point in 2025, 2026? That's a two-part question. Thank you.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, Charles. So Charles' question is really on CoWoS. First, he would like to clarify, we said that CoWoS capacity is more than doubling in 2024. He said, did we say, is he correct to understand we said it will double again in 2025? That's the first clarification.

And then he would like to know, as customers migrate from CoWoS-S to CoWoS-L and CoWoS-R solution, a lot of technical challenges or benefits -- changes, sorry, not challenges. Does it help alleviate the capacity constraints and would that allow CoWoS to reach supply, demand balance in 2025? So one to clarify and one on the different solutions.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Well, all right. Charles, you really know all the detail of the technology. You know the CoWoS-R, CoWoS-S, CoWoS-L, blah, blah, blah. All these kind of thing is because of our customers' requirement. Even the same customer, they have different approaches for their different products.

When I say that we doubled the capacity, this is the summing all the different version of the CoWoS together. Which portion is really double? Which portion is much more than the other one? I'm not going to share with you because this is related to my customers' demand.

So from last year to this year, we have more than doubled. And as I said, from this year to next year, we want to double again or, probably, we want to more than double again. But still, I have to work with our OSAT partner to increase the overall supply to support my customer.

Whether that this kind of different version of the CoWoS will give me some flexibility today, yes and no. Because different version has a different tool set. But in common, some of the tool can be used by all the CoWoS, okay, but different versions have a different demand.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay. Thank you, C. C. Thank you, Charles. We'll come back to the floor for the next two questions, please. We'll take the first one from Laura Chen from Citigroup, and then we'll go to Sunny Lin from UBS.

Laura Chen - *Citi - Analyst*

Thank you, Jeff. Thank you for taking my question. My first question is also on the advanced node. I remember, C. C., you mentioned earlier that every clients are now engaged with you on the 2-nanometers migration. So I'm just wondering that, when we enter in maybe 2026, the third -- the second year, can we expect that the revenue contribution initially will be larger than what we had comparing to N3? And also wondering that since the performance is much better, so can we expect the dilution's period will also be shorter than N3?

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay. Sorry, sorry. So Laura's first question is about N2 basically, that almost every customer is engaging with TSMC on 2-nanometer technology. So her question is, do we expect the revenue contribution from N2 in 2026, therefore, to be larger than compared to N3 at a similar point in time of the ramp? And also, correspondingly, will the N2 margin dilution be less or better than N3, basically.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

I will give this kind of money's question to the CFO.

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

All right, Laura. The revenue, yes, it's going to be bigger. Gross margin dilution, it will be faster to reach corporate average.

Laura Chen - *Citi - Analyst*

That's very clear and helpful, thank you. And also, my second question is also on the packaging side. So we know that, last time, we also discussed an Edge AI will also benefit for TSMC in terms of the advanced nodes, the die areas. Just wondering that, do you also see your Edge AI device clients, they are moving to 3DIC or SoIC any times in the next two years? Or before that happening, can we expect more clients on the smartphone side, they will also adapt maybe InFO first? Because so far, our understanding is that, InFO, you only have one advanced, one single client. I'm just wondering that, if we see that more clients to move to on the Edge AI side on advanced packaging. Thank you.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay. So Laura's second question is very specific. But again, in regards to advanced packaging, with more and more customers working on Edge AI devices without, well, being overly specific, but what does it mean or the implication for advanced packaging solutions that we expect in the next two years to see these Edge AI customers start to use SoIC or 3DIC, particularly smartphone? Will they still be using InFO or will they also consider these solutions as well. Is that correct, Laura? Okay.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Well, very technical questions. Let me share with you, as my customer moving into 2-nanometer or A16, they all need to probably take in the approach of chiplets. So once you use your chiplets, you have to use in advanced packaging technologies.

On the Edge AI, for those kind of smartphone customers, as compared with the HPC customers, HPC is moving faster because of bandwidth concern, latency, footprint, or all those kind of thing. For smartphone customers, they need to pay more attention to the footprint as well as the functionality increase. So you observe my big customers taking the InFO first and then for a few years and nobody catch it up, they are catching up. Okay.

Laura Chen - *Citi - Analyst*

Thank you very much, C.C.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay. Thank you, Laura. We'll take the next question from Sunny Lin from UBS, and then we'll go back to the call.

Sunny Lin - *UBS Equities - Analyst*

Thank you, Jeff. Good afternoon, C.C. and Wendell. Thank you for taking my questions. So my first question is on your business opportunities for smartphone and PC. Last few years, both were ex-growth for quite some time. And so, how we should think about the units and silicon content for the coming two, three years? First part, a lot of questions on the tight supply for 5- and 3-nanometer? And so, are your customers engaging with you early on the planning into 2025 capacities for a better upgrade cycle?

And then for silicon content, recall a few years back when 5G just started to ramp. You used to provide the silicon content expectations of 5G, high-end, and mid-end, and low-end smartphones. So I wonder, at this point of time, if you have any estimates for AI for smartphone going to next two, three years?

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, several parts to Sunny's first question, she's looking at smartphone and PC. So the first part is, she wants to know, in terms of unit in silicon content, what is our expectation for smartphone and PCs in next few years? N5 and N3 supply is very tight in terms of the capacity. Can -- do we have enough capacity to support a potential unit or upgrade cycle? And last but not least, she's asking us to quantify the silicon content per device per segment from Edge AI.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

That's a very long question but let me answer the content first. AI is so hot so that's -- right now, everybody, all my customers want to put the AI functionality into their Edge devices. And so, the die size will be increased. Okay, how much? I mean, it's different from my customer-to-customers' products. But basically, probably 5% to 10% die size increase will be the general rule.

Unit growth, not yet. Because we did not see kind of unit growth suddenly increased, but we expect this AI functionality was stimulated some of the demand, so stimulate the replacement to be shorter. So in terms of unit growth that in a few years later, probably two years later, you will start to see a big increase in the Edge device that's smartphone and PC.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

And will we have enough capacity to support?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

That's the one I tried to avoid the answer. It's very, very tight, and we are working very, very hard to get enough capacity to support my customers from now all the way to next year to 2026.

Sunny Lin - *UBS Equities - Analyst*

Got it. Thank you, C.C., for the answer. So my second question is try to look at the demand profile from different perspective. If we look back in 2021 or early 2022, back then, demand was also pretty high. Customers were very aggressive on the demand forecast. Now, looking at GenAI, obviously, the technology has lots of great potential, but a new technology also has lots of volatilities where you start to ramp. And so, how are we managing the volatilities of the demand? Why do you think, this time around, it is different versus COVID period? How do we get comfortable with our capacity planning?

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, thank you, Sunny. So Sunny's second question, is goes back to TSMC capacity planning and CapEx framework. So she notes we -- today, generative AI-related demand is very strong, but she also notes a few years ago, back in 2021 and '22, demand was also very strong. Many customers were also very positive or upbeat on the future demand.

And so, today, with such strong generative AI demand, how does TSMC plan its capacity appropriately? How do we manage -- I think your word was volatility -- how do we manage the risk, basically, I guess, of not overbuilding capacity in this type of environment?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

I thought I explained that our capacity planning process and the investment, we have -- I put a wording of discipline. That means we are not going to repeat the same kind of mistake that we have in 2021, 2022.

Now this time, again, we look at the overall very big demand forecast for my customer. And so, I look at it into -- actually the whole company with many people now examining and studying that reality is that AI is so useful, will be used by a lot of people or not.

And we test ourself first. Inside TSMC, we are using AI. We are using machine learning skill to improve our productivity, and we found out it's very useful. And so, I'm also in the line to buy my customer's product, and we have to form in the line. Like, I cannot privilege here, I'm sorry, but it's useful.

And so, I believe that this time, AI's demand is more real than two or three years ago. At that time, it is because people were afraid of a shortage, and so automotive, everything, you name it, they are all in shortage. This time, AI alone, only AI alone, it will be a very useful tool for the human being to improve all the productivity in our daily life, be it in medical industry or in any product, manufacturing industry, or autonomous driving, everything you need AI. And so I believe it's more real. But even with that, we also have a top-down, bottom-up approach and discuss with our customers, and ask them to be more realistic. I don't want to repeat the same kind of mistake two or three years ago, and that's what we are doing right now.

Sunny Lin - *UBS Equities - Analyst*

Great to know. Thank you very much.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, thank you. Operator, can we move on to the next participant from the line, please? Okay. If not, then maybe we'll take the last two questions from the floor, one or two. Let's start here and then here. So we'll start with Arthur Lai from Macquarie.

Arthur Lai - *Macquarie Research - Analyst*

Hi, C.C., and Wendell, and Jeff. Thanks for taking my question, Arthur Lai from Macquarie. I used to cover the downstream tech and especially data center before. And so, I want to ask C.C. about the SPR because I think this is very important from the data center perspective.

So when you bring the new technology, you can save around 20% power. Can we also think about, you can save the total systems' power consumption by another 20%. So it's a big change, and from the customer you asked or you spoke to, they can also -- you said the total cost of our own operation, so it becomes the more you buy, the more you save, yeah.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, so Arthur's first question, he would like to understand more about Super Power Rail or our best-in-class backside power solution as it relates to data center demand. He knows, as we said, that it brings greater power efficiency from the chip level. His question, without specific numbers, but what does it mean for the system level power consumption saving? What does it mean for our customers' ability in terms of total cost of ownership in terms of the power savings? And does it mean that, the more you buy, the more you save?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

The more you buy TSMC's wafer, the more you save, yes. Sorry, I just want to -- I like my customer. Your question, Arthur, you say that 20% saving in the chips power consumption, does that directly reply to indicate that the system power consumption will reduced by 20%? Probably not, because of the whole system, including the connection, including the networking, including the processes of power consumption. So unless every component save 20%, then you can achieve 20%. But again, the accelerator or the CPU is a big portion of the whole system's power consumption. So even it is not 20%, it's a significant portion of it. And so that's why all my customers want to using the leading edge, and they are very aggressive to move into the 2-nanometer technology.

Arthur Lai - *Macquarie Research - Analyst*

Thank you. So I also encourage the company to do the right thing, so energy efficiency computing is definitely our goal for human beings. And then, so I also -- I would like to get more color about when you go into the A16 and when we expand the capacity, what do you think the biggest bottleneck would be?

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay. So Arthur's second question is in terms of A16. What would be the biggest bottleneck to expand our capacity of A16 to support our customers, if any?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

We always say that, when TSMC want to expand the capacity, we need the land, we need the electricity, we need the talented people, and so all the above.

Arthur Lai - *Macquarie Research - Analyst*

Thank you, C.C.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay. Thank you. And then in the interest of time, we'll take question from the last participant on the floor, which is Brad Lin from Bank of America Merrill Lynch.

Brad Lin - *BofA Global Research - Analyst*

Thank you, Jeff, for taking my questions. So I have two questions. The first one would be on the -- during the COMPUTEX. We obviously have seen quite some big tech companies announced that they are going to accelerate the product launch cadence. So what's the implication to TSMC? Should that give TSMC a better visibility on the pipeline and also the capacity planning? And on the other side, so what are the major challenges that you might face with this pace or cadence?

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, so Brad's first question is that, at COMPUTEX recently, several companies announced their intention to accelerate their product cadence or product launches. So his question is, what does this mean, implications to TSMC in terms of capacity planning, in terms of supporting our customers, et cetera, et cetera. Is that right? Okay.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Well, we like this kind of a trend because of TSMC is very good at the leading-edge development. And so we -- actually, every product, when they design, it takes 1.5 years to 2 years. So we got this kind of message, but quite a long time ago. My customer announce it because they are so happy. And so we are happy also, because they want us to see our value. So I take that advice.

Okay, so to answer your question, yes, we have been prepared. And not only because of in June, they announce it. We, much earlier, we already discussed with them, and we prepare for these kind of changes.

Brad Lin - *BofA Global Research - Analyst*

Got it. Thank you very much. So I would assume that would help us kind of sell the value easier. So the second question will be on the -- well, obviously, we also see the bigger footprint of the AI chips. So while there are quite some activities about fan-out panel-level packaging. So do you think that that solution will become the mainstream in the mid to long run or does TSMC have any plan to do the related investment?

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

Okay, so Brad's second question is that, again, with AI-related chips that they're larger and larger die sizes, so his question is in terms of advanced packaging and specifically fan-out panel-level packaging. Is this something that TSMC is looking at or exploring to do? Would this be something for TSMC in the mid to long term?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Yes, we are looking at this as kind of a panel level fan-out technology. But the maturity today is not yet. So I -- personally, I will think it's about at least three years later. In this -- within these three years, we don't have any very solid solution for a die size bigger than 10 times of the reticle size. Today, we support our customer all the way to 5x, 6x chip size. I'm talking about the field size, the biggest field size. Three years later, I believe the panel fan-out will be -- start to be introduced and we are working on it.

Brad Lin - *BofA Global Research - Analyst*

And we will be ready for it as well?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Of course.

Jeffrey Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations*

All right. Thank you, C.C. Thank you, Brad. Thank you, everyone. This concludes our Q&A session. Before we conclude today's conference, please be advised that the replay of the conference will be accessible within 30 minutes from now, and the transcript will become available 24 hours from now, both of which are going to be available through TSMC's website at www.tsmc.com.

So thank you, everyone, for joining us today. We hope everyone continues to stay well, and we hope you will join us again next quarter. Goodbye, and have a great day.