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PRESENTATION

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

(spoken in foreign language)

Good afternoon, everyone, and welcome to TSMC's second-quarter 2025 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. If you're joining us through the conference call, your dial-in lines are in listen-only mode.

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 2025, followed by our guidance for the third quarter 2025. Afterwards, Mr. Huang and TSMC's Chairman and CEO, Dr. C.C. Wei, will jointly company's key messages. Then we will open both the floor and the line for the question-and-answer session.

As usual, I would 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 on 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 financial highlights for the second quarter 2025. After that, I will provide the guidance for the third quarter of 2025.

Second-quarter revenue increased 11.3% sequentially in NT as our business was supported by strong demand for our industry-leading 3-nanometer and 5-nanometer technologies, partially offset by an unfavorable foreign exchange rate. In US dollar term, revenue increased 17.8% sequentially to \$30.1 billion and exceeded our second-quarter guidance.

Gross margin decreased 0.2 percentage points sequentially to 58.6%, primarily due to an unfavorable foreign exchange rate and margin dilution from our overseas fabs, partially balanced by higher capacity utilization and cost improvement efforts. Operating margin increased 1.1 percentage points sequentially to 49.6%. Overall, our second-quarter EPS was TWD15.36, up 60.7% year over year; and ROE was 34.8%.

Now let's move on to revenue by technology. 3-nanometer process technology contributed 24% of wafer revenue in the second quarter, while 5-nanometer and 7-nanometer accounted for 36% and 14%, respectively. Advanced technologies, defined as 7-nanometer and below, accounted for 74% of wafer revenue.

Moving on to revenue contribution by platform. HPC increased 14% quarter over quarter to account for 60% of our second-quarter revenue. Smartphone increased 7% to account for 27%. IoT increased 14% to account for 5%. Automotive stayed flat and accounted for 5%. And DCE increased 30% to account for 1%.

Moving on balance sheet, we ended the second quarter cash and marketable securities of TWD2.6 trillion, or USD90 billion. On the liability side, current liabilities decreased by TWD22 billion quarter over quarter, mainly due to the decrease of TWD38 billion in accrued liabilities and others. The decrease in accrued liabilities and others was mainly due to the payment of income tax.

On financial ratios, accounts receivable turnover days decreased 5 days to 23 days. The decrease in accounts receivable was mainly due to NT dollar appreciation as almost all of our accounts receivable are in US dollars. Days of inventory decreased 7 days to 76 days, primarily due to higher N3 and N5 wafer shipments.

Regarding cash flow and CapEx, during the second quarter, we generated about TWD497 billion in cash from operations, spent TWD297 billion in CapEx, and distributed TWD117 billion for third quarter '24 cash dividend.

Taking the unfavorable exchange rate into consideration, our cash balance decreased TWD30.3 billion to TWD2.36 trillion at the end of the quarter. In US dollar terms, our second-quarter capital expenditures totaled \$9.6 billion.

I've finish 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 USD31.8 billion and USD33 billion, which represents an 8% sequential increase, or a 38% year-over-year increase at the midpoint. Based on the exchange rate assumption of USD1 to TWD29, gross margin is expected to be between 55.5% and 57.5%; operating margin between 45.5% and 47.5%. In addition, we maintain our 2025 capital budget to be between USD38 billion and USD42 billion.

This concludes my financial presentation. Now let me turn to our key messages. I will start by talking about our second-quarter '25 and third-quarter '25 profitability. Compared to first quarter, our second-quarter gross margin slightly decreased by 20 basis points sequentially to 58.6%. This was primarily due to an unfavorable foreign exchange rate and margin dilution from our overseas fabs, partially offset by higher-than-expected overall capacity utilization and cost improvement efforts.

Compared to the first quarter foreign exchange rate of \$1 to TWD32.88, the actual second-quarter exchange rate was \$1 to TWD31.05. This created about 220 basis points margin headwind to our actual second-quarter gross margin. We also experienced slightly more than 100 basis points impact, mainly as the margin dilution from our Arizona fab started to kick in.

We have just guided our third-quarter gross margin to decrease by 210 basis points to 56.5% at the midpoint, primarily due to the continued unfavorable foreign exchange rate and more pronounced dilution from overseas fabs, as we ramp up further in Kumamoto and Arizona. We continue to forecast the gross margin dilution from the ramp-up of our overseas fabs in the next five years, starting from 2025, to be between 2% to 3% every year in the early stages and widen to 3% to 4% in the latter stages.

Despite the higher cost of overseas fabs, we will leverage our increasing size in Arizona and work on our operations to improve the cost structure. We will also continue to work closely with our customers and suppliers to manage the impact.

Overall, with our fundamental competitive advantages of manufacturing technology leadership and large-scale production base, we expect TSMC to be the most efficient and cost-effective manufacturer in every region that we operate.

Now, let me make some comments on the impact of foreign exchange rate on TSMC's revenue and profitability. NT dollar is the reporting currency of our financial statements. Nearly all of our revenue is in US dollars, while about 75% of cost of goods sold is in NT. Therefore, fluctuations in the exchange rate between US dollar and NT will have a sizable impact to our reported revenue and gross profit margin.

The sensitivity of the revenue to dollar NT exchange rate is nearly 100%. That is, every 1% appreciation of NT against US dollars will reduce our reported NT revenue by 1%. The sensitivity of our gross margin to the same 1% exchange rate change is about 40 basis points. That is, if NT appreciates 1 % against the dollar, our gross margin will come down by about 40 basis points.

Compared with our second-quarter exchange rate guidance of \$1 to TWD32.5 provided on April 17, the NT dollar has appreciated by an average of about 4.4% sequentially, which negatively impacted our second-quarter revenue by about 4.4% in NT and our gross margin by about 180 basis points. For third quarter of '25, based on the current exchange rate of \$1 to TWD29, the average NT dollar will appreciate by another 6.6% sequentially, which will negatively impact our third-quarter revenue by 6.6% in NT and reduce our gross margin by about 260 basis points.

As a reminder, six factors determine TSMC profitability: leadership technology development and ramp-up; pricing; capacity utilization; cost reduction; technology mix; and foreign exchange rate, which is not in our control. When the foreign exchange rate is unfavorable as it is currently, we will focus on the fundamentals of our business and lean on the other five factors to manage through it, and we have successfully done in the past. Thus, even with the unfavorable foreign exchange rate, we believe a long-term gross margin of 53% and higher remains well achievable.

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 USD30.1 billion, above our guidance in US dollar term, mainly due to continued robust AI and HPC-related demand.

Moving into the third-quarter 2025, we expect our business in the third quarter to be driven by strong demand for our leading-edge process technologies.

Looking to second half of 2025, we have not seen any change in our customers' behavior so far. However, we understand there are uncertainties and risk from the potential impact of tariff policies, especially on consumer-related and the price-sensitive market segment.

While we observe rebate program in China stimulating some near-term demand upside, we believe this is short term in nature and continue to expect a mild recovery in overall non-AI market segment in 2025. Having said that, we believe the demand for semiconductor is very fundamental and will continue to be robust.

Recent developments are also positive to AI's long-term demand outlook. The explosive growth in token volume demonstrates increasing AI model usage and adoption, which means more and more computation is needed, leading to more leading-edge silicon demand. We also see AI demand continuing to be strong, including the rising demand from sovereign AI. Therefore, we now expect our full-year 2025 revenue to increase by around

30 % in US dollar term, supported by strong demand for our industry-leading 3-nanometer and 5-nanometer technologies underpinned by growth in our HPC platform.

Amidst the uncertainties, we will remain mindful of the potential tariff-related impact and be prudent in our business planning going into second-half 2025 and 2026, while continuing to invest for the future megatrend. We are also focused on the fundamentals of our business: technology leadership, manufacturing excellence, and customer trust, to further strengthen our competitive position.

Next, let me talk about the TSMC's global manufacturing footprint update. All our overseas decisions are based on customer needs, as they value some geographic flexibility, and a necessary level of government support. This is also to maximize the value for our shareholders.

With the strong collaboration and support from our leading US customers and the US federal, state, and city government, we announced our intention to invest a total of USD165 billion in advanced semiconductor manufacturing in the United States. The expansion includes plans for six advanced wafer manufacturing fabs in Arizona, two advanced packaging fabs, and a major R&D center to support the strong multi-year demand from our customers.

Our first fab in Arizona has already successfully entered high volume production in 4Q 2024, utilizing N4 process technology with a yield comparable to our fabs in Taiwan. The construction of our second fab, which will utilize 3-nanometer process technology, is already complete. We are seeing strong interest from our leading US customers and are working on speeding up the volume production schedule by several quarters to support their need.

Construction of our third fab, which will utilize 2-nanometer and the A16 process technologies, has already begun, and we are looking to speeding up the production schedule as well, based on the strong AI-related demand from our customers. Our fourth fab will utilize N2 and the A16 process technologies. And our fifth and sixth fabs will use even more advanced technologies. The construction and ramp schedules for those fabs will be based on our customers' need.

Our expansion plans will enable TSMC to scale up to a GIGAFAB cluster in Arizona to support the needs of our leading-edge customers in smartphone, AI, and HPC applications. We also plan to build two new advanced packaging facilities and establish an R&D center to complete the AI supply chain.

After completion, around 30% of our 2-nanometer and more advanced capacity will be located in Arizona, creating an independent leading-edge semiconductor manufacturing cluster in the US. Thus, TSMC work continue to play a critical and integral role in enabling our customers' success. We will also remain a key partner and enabler of the US semiconductor industry.

Next, in Japan, thanks to the strong support from the Japan Central, Prefecture, and local governments, our first specialty technology fab in Kumamoto has already started volume production in late 2024 with very good yield.

The construction of our second specialty fab is scheduled to start later this year, subject to the readiness of the local infrastructure. The ramp schedule will be based on our customers' need and market conditions.

In Europe, we have received strong commitment from the European Commission and the German federal, state, and city governments and are progressing smoothly with our plans to build a specialty technology fab in Dresden, Germany. The ramp schedule will also base on our customers' needs and market conditions.

In Taiwan, with support from the Taiwan government, we plan to build 11 wafer manufacturing fabs and 4 advanced packaging facilities over the next several years. We are preparing for multiple phases of 2-nanometer fabs in both Hsinchu and Kaohsiung Science Parks to support the strong structural demand from our customers. By expanding our global footprint while continuing to invest in Taiwan, TSMC can continue to be the trusted technology and capacity provider of the global IC industry for years to come, while delivering profitable growth for our shareholders.

Now let me talk about our N2 and A16 status. Our N2 and A16 technologies lead the industry in addressing the insatiable demand for energy efficient computing, and almost all the innovators are working with TSMC. We expect a number of new tape-outs for 2-nanometer technology in the first two years to be higher than both 3-nanometer and 5-nanometer in their first two years, fueled by both smartphone and HPC applications.

N2 deliver full-node performance and power benefits, with 10 to 15% speed improvement at the same power or [25%] (corrected by company after the call) to 30% power improvement at the same speed, and more than 15% chip density increase as compared with the N3E.

N2 is well on track for volume production in the second half of 2025, as scheduled, with a RAM profile similar to N3. With our strategy of continuous enhancement, we also introduced N2P as an extension of our N2 family. N2P features further performance and power benefits on top of the N2, and volume production is scheduled for second-half 2026.

We also introduced A16 featuring our best-in-class Super Power Rail, or SPR. Compared with the 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 products with complex signal routes and dense power delivery networks. Volume production is on track for second-half 2026.

We believe N2, N2P, A16 and its derivatives will fuel our N2 family to be another large and long-lasting node for TSMC.

Finally, let me talk about our A14 status. Featuring our second-generation nanosheet transistor structure, A14 will deliver another full node stride from N2, with performance and power benefits to address the increasing structural demand for high performance and energy efficient computing. Compared with N2, [A14] (corrected by company after the call) will provide 10% to 15% speed improvement at the same power or [25%] (corrected by company after the call) to 30% power improvement at the same speed and about 20% chip density gain.

Our A14 technology development is on track and progressing well with device performance and yield improvement on or ahead of schedule. Volume production is scheduled for 2028. We will continue our strategy of continuous enhancement with A14, including a Super Power Rail offering planned for 2029. We believe A14 and its derivative will further extend our technology leadership position and enable TSMC to capture the growth opportunities well into the future.

This concluding our key message, and thank you for your attention.

QUESTIONS AND ANSWERS

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Thank you, C.C. This does conclude our prepared statements. (Event Instructions)

So now, let's begin the question-and-answer session. We'll take the first few questions from the floor, then we'll flip and alternate to those on the line. Maybe we'll go left, center, and then sequence.

And we'll start here with Gokul Hariharan from JPMorgan.

Gokul Hariharan - JPMorgan - Analyst

Thanks, Jeff. And good afternoon, C.C. and Wendell. First question on demand. I think, C.C., you mentioned data center AI demand definitely looks better than maybe three months back. Last quarter, you also mentioned CoWoS capacity will probably come into balance by 2026. Is that still our view? Or you think that the capacity now starts to look tighter?

Second, I think you talked about on-device AI as a potential future driver. Are you seeing more development on the on-device AI part? Is it better compared to maybe three, six months back?

And lastly, near term, your 4Q looks like you are expecting revenue to decline. Is that based on what your customers are telling us, especially on the consumer side? Or is it just TSMC being cautious and conservative in terms of the guidance?

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. Gokul, thank you. Again, for the benefit of those, of course, here in person and on the line, please allow me to summarize your questions. So maybe we'll take them one by one.

His first question is on the demand, particularly data center and AI-related demand. As C.C. said in his remarks, it is certainly still even stronger. So his question is about the advanced packaging and CoWoS demand into 2026. How do we see the supply-demand gap narrowing or becoming more balanced for CoWoS specifically?

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

Gokul, the demand from the AI getting stronger and stronger. If you pay attention to what the \$4 trillion company's CEO said -- and so the megatrend for the AI is continue to be strong, and so is the CoWoS. And so now we are -- again, we are in a mode trying to narrow the gap. I don't want to use that balance. The last time you guys misunderstood what I said. You thought it's a bad wording. So I will say we try to narrow the gap, alright? So momentum's still there and very healthy.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. And then the second question or second part is on on-device or Edge AI. Gokul wants to know how is the development of customers to work on on-device AI compared to maybe three to six months ago. What is the interest or activity level and how do we see this?

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

As the last time I say it, I say that it takes one to two years for my customer to complete their new design of the product. The movement is still going. They are still continuing to -- as time goes by, as I said, the increase on the edge device, the number of the units is actually mild, but the die size increased. We continue to see that. And the die size increased by about 5% to 10%.

And that kind of trend continued. Okay, so you have to wait another probably six months to one year to see an explosion.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay, and then Gokul's second question of the final part on the near term. I think, Gokul, your question is with our third-quarter guidance implies fourth quarter, is there any particular reason or any comment that we want to make about the implied fourth quarter?

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

I think you did not mention Gokul's comments there or you are become conservative. That comment is more real. We are a company that when we say we achieve and achieve the high target. So your calculation, I think, Charlie also -- he's nodding. So a lot of you is calculating our reported number so that you can easily see that our fourth quarter is decreasing.

We take into the consideration of the possible impact of tariff and a lot of other uncertainties, so it become more conservative. That's our current attitude. But I guarantee you with our technology leadership position and excellent manufacturing, if there are any opportunities, we will catch and be expected that we are achieve our high-end target.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay, thank you, C.C. Thank you, Gokul. Sorry, let's go one by one. Second question, then maybe Charlie Chan from Morgan Stanley.

Charlie Chan - Morgan Stanley - Analyst

Thanks for taking my question. Good afternoon, C.C., Wendell, and Jeff. So first of all, congrats for very strong results, and especially on the gross margin side. A very good execution indeed.

So my first question is really also on the gross margin, because the accumulated effect in pay is almost like 4.4 percentage points. So it's too big to ignore. So when TSMC consider your 2026 wafer pricing, so-called reflecting your value, would you consider this FX impact?

And is our company confident to keep your margin similar to this year's level? I feel like 53% is a low bar. So I just want to -- maybe a little bit high and see if that FX impact can be considered to reflect your value. Thank you.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. So Charlie's first question is on margin and I guess pricing. He notes, obviously, as Wendell said the big move in the exchange rate and therefore big impact to our profitability and gross margin. So his question is looking ahead to 2026, can we reflect or earn our value from the including the FX impact into the pricing, and therefore what is our confidence level on the gross margin for next year? Can it keep a similar level as this year?

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

Well, let me assure you that, yes, the impact from the exchange rate is huge. You try to imply that whether we will sell our value. Let me answer that. We are working on it. And we have confidence that the 53% gross margin and higher, I still want you guys to pay more attention to "and higher." Okay, thank you.

Charlie Chan - Morgan Stanley - Analyst

Okay. Thanks. Hopefully, it will work out well. My second question is also a very hot topic recently about the H20 chip shipping to China. I remember three months ago, there was another question on this matter, right, meaning that back then I believed that shipping was a suspend, but you're still very confident about your mid-40% CAGR for cloud semi growth in the coming five years.

Now China becomes your addressable market again. Do you think that mid-40% CAGR target can be revised up?

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. Thank you, Charlie. So Charlie's second question is around the AI accelerator demand. He notes, of course, our customers' product, H20 recently, is now seems to be able to ship to China versus three months ago it was not. So his question really is our long-term AI accelerator growth CAGR to grow close to mid-40s, can it be higher? Do we think it will be higher? Is there upside to this?

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

Charlie, the H20 now, again, according to the \$4 trillion company's CEO, we did not receive the signal yet, so it's too early to give you an estimate. But certainly, it is a good news, right? I mean that China is a big market and my customer can still continue to supply the chip to the big market, and it's a very positive news for them and in return is a very positive news to TSMC.

Whether we are ready to increase our forecast, not yet. Another quarter, probably will be more appropriate to answer your question.

Charlie Chan - *Morgan Stanley - Analyst*

Thanks for your comment. It's very helpful. Thanks.

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

Thank you, Charlie. Okay, then we'll move on to the right side of the room for us. Bruce Lu from Goldman Sachs.

Bruce Lu - *Goldman Sachs - Analyst*

Thank you for taking my question. I think Charlie already asked the profitability question already. So I'll just move on to your N2 ramp. So what's the revenue contribution we can expect for the N2 ramp for next year? I'm a little bit surprised to hear that the N2 ramp is similar rate with N3. With N2, you do have both HPC and smartphone customer ramping on the same stage in the first slide, year one or year two, right? Can we expect like, 15 % revenue contribution coming from N2 for next year or a similar level compared to N2, which is around like 10%, 11% for the year two?

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

Okay. Bruce's first question is around the N2 ramp. His question is about the ramp and the ramp profile, because we said the N2 ramp profile is similar to N3. So what does that mean? And then also, of course, what contribution do we expect or can we share for N2 in 2026?

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

Bruce, you have a good argument. Usually, we ramp up a new node using the smartphone. You knew that; everybody knew it. Now, it's not only a smartphone but also HPC product. However, the ramping profile I just reported is similar to 3-nanometer.

It's limited by our capability to build a new fab to ramp it up and also a little bit straightforward is constrained by the capacity. So we say the ramp profile is similar to N3, but the revenue contribution certainly will be bigger because you don't expect our N2 is the same price as N3, right?

Bruce Lu - *Goldman Sachs - Analyst*

Of course.

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

Good. Thank you.

Bruce Lu - *Goldman Sachs - Analyst*

If that is the case, we should assume like in '27, the N2 ramp-up will be faster, right? Because you take 12, 18 months for you to build new fab, you should be able to achieve even higher growth in N2 in '27, right?

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

So Bruce is asking if the revenue contribution is higher in '26, then should it be even greater in '27.

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

We will answer that question in '26. Thank you.

Bruce Lu - *Goldman Sachs - Analyst*

Okay. The next question is for N5 and N3, right? So I want to understand the supply demand for the N5 and N3 in the coming two years as most of the AI will migrate to N3 next year. But it seems to me that the N5 conversion is mostly done – N5/N3 conversion is mostly done. And we don't really see like greenfield capacity expansion from N3.

So it becomes like super tightness for the N3 for the coming years. So does that mean that N5 will be lower utilized or we try to build more N3 in the future? Or what kind of -- or we should see -- we can sell our more value for N3, N5 next year?

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

Okay. Bruce's second question is around N5 and N3. He wants to know what is the outlook, the supply/demand at these two advanced nodes the coming two years. His observation, AI products will migrate to N3, and the N5 to N3 conversion is mostly done. So his question is, will 3-nanometer supply be very tight in the next few years.

And I think the last part, therefore, can we earn our value or price for that tightness. And then on the flip side, what about 5-nanometer, will it become lower utilization?

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

I'd like your comment on that we have to sell our value because we're tight in N3 capacity. It will be continued for a couple of years, very tight. And in fact, N5 also very tight. The demand is high because a lot of our AI products still in the 4-nanometer technology node, and they will transition to 3-nanometer probably in the next two years. So in meanwhile, N5 are still very tight in capacity. N3, even tighter. And so we are working hard.

One of the TSMC's advantages is that we have GigaFab cluster. And so we have between N7, N5, N3, even the future N2, we have almost for each node, we have about 85% to 90% common tools. So it's not free, but it's much easier for TSMC to adjust or convert the capacity between those nodes.

And today, let me share with you, we are using the N7 capacity to support N5 because the N5 is too tight. And then we are converting N5 to N3 as you just pointed out. We'll continue to do that.

And so today, our leading edge technology's capacity, we define N7 and below are all very tight. And seeing that, we are working very hard to -- again, using my sentence, to narrow the gap between the demand and the capacity.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. Thank you, Bruce. Let's go to the participants online. Maybe we'll take two questions from the online, and then we'll come back to the floor. Thank you. Operator?

Operator

Now asking question, Brett Simpson, Arete.

Brett Simpson - Arete Research - Analyst

I had a question for Wendell on gross margins. And it's always helpful you've laid out a framework for some of the puts and takes to TSMC's gross margins. But my question is really some of these headwinds like FX and the dilution from overseas fabs are more structural cost increases. And to what extent can TSMC adjust wafer pricing higher to neutralize these cost increases in your business?

And I guess, secondly, on this point, how much economic benefits are you seeing from applying AI across the fabs? I mean I think NVIDIA has mentioned that they're working with TSMC closely, strategically in areas like computational lithography to try to drive further fab efficiencies. So can you maybe just give us some examples where you're seeing real gains in your cost structure? And are we at a point where you're starting to see several points of gross margin benefit from AI efficiencies? Thanks.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

All right, Brett. So Brett's first question is a little bit involved. But looking at our gross margin and profitability, he notes that the unfavorable exchange rate and the dilution from the overseas due to the higher costs, these are structural headwinds. So his question is, how can we, or can we earn our value or adjust our wafer price to help offset some of these?

And also, how much -- we've talked about before about using AI ourselves in our operations, how much economic benefit are we deriving from things such as the CuLitho with our customers? And are there other examples of using AI where it's helping our cost structure? And can we quantify that -- quantify the benefit, sorry.

That's your question, right, Brett?

Brett Simpson - Arete Research - Analyst

That's right. Thanks, thanks.

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

Okay. Brett, the first question, gross margin. That's the reason why we've been talking about the six factors affecting our profitability. I don't think I need to repeat those six factors. But whenever, for example, using foreign exchange rate as an example, a few years ago, there were also a period of time that foreign exchange rates were against us. So we are able to lean on the other factors to help us mitigate the negative impact from certain factors and, therefore, still achieve our gross margin targets.

And you specifically asked about ASP of raising the price, but the price is just one of the factors. And I believe C.C. just elaborate a lot on earning our value. And at the same time, there are other factors that we can leverage on. So all in all, that's why we're saying 53% and higher and higher gross margin is still achievable.

Your second question on AI benefits. I think we also talked about that before. We used that in operation, in manufacturing. We also use that in R&Ds. And just think about if we are able to produce 1% of productivity gains in a company of our size, that equals to USD1 billion. So that's the number we can share with you without going into too much other details.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Does that answer your question, Brett?

Brett Simpson - Arete Research - Analyst

Yeah, that's great. Thanks very much, Wendell. I guess my follow-up question, I guess, just digesting your prepared remarks, C.C., you mentioned 11 fabs in Taiwan. I think I count eight fabs for overseas that you're planning that aren't commercially online yet.

Can you maybe just talk a bit about -- I mean I've never seen that type of roadmap before from TSMC. It's quite big. Can you maybe share with us if you're planning a bigger expansion of new capacity next year?

And I say this because in the last few months, we've seen so many gigawatts data center announcements. I think this week, we had one from Meta that was significant. So the demand looks very strong, and I'm just wondering whether you have enough capacity to satisfy demand next year and whether you plan to convert further 5-nanometer to 3-nanometer and how you see the N2 capacity plans for 2026.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. Brett's second question, he notes that we are building many fabs, both in Taiwan and also overseas. He's never seen this size or scale of capacity expansion from TSMC before. So it's very -- and he also notes that demand from data centers continues to be very strong. So his question is basically very simply, do we have enough capacity to support the strong demand specific to next year and also very specifically to 2-nanometer? And will we further also convert more 5-nanometer to 3? That's, I think, all of this question.

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

Brett, your observation is right. Recently, we saw a lot of announcement of the AI data center over the world. And the demand on 3-nanometer -- actually on 5-nanometer, 3-nanometer, and the future 2-nanometer are very high. And we did not see this kind of strong demand for a long time, but will it be enough to support them? I still want to use my word, say that we try very hard to narrow the gap between the demand and the supply. We're working very hard.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. Thank you, Brett. Let's go to the next participant on the call.

Operator

Arthur Lai, Macquarie.

Arthur Lai - Macquarie - Analyst

Arthur Lai from Macquarie. Again, congrats on a strong result. I would like to follow up on the N2. I think as C.C. highlight, this is a very exciting node we have heard. And then I want to follow up on the return on investment. Can you compare to the N2 and N3 the return on investment and then give us more color?

Second one is the reason we ask this question is because the CapEx per area, actually, N2 is higher, right? And then we also heard from industry that the company's yield on the N2 is also pretty good. So can you give us some put and take on how we think of the N2's future development? Thank you.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. So Arthur's question -- both questions, I think, are around N2. N2, as you said, is a very exciting node. He would like to know understand what is the return or the return on investment that we see from N2 compared to N3.

And also, can we talk a little bit about N2 -- the CapEx is higher, but the yield is still very good. What is the developments that we're seeing for 2-nanometer? I think that's -- Is that your question, Arthur?

Arthur Lai - Macquarie - Analyst

Yes, yes. Yeah, exactly.

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

Okay, Arthur, N2 return. As we said before, N2, the profitability is better than N3. Now there were questions asking how many quarters to catch up with the corporate before. And N3 was -- it took N3 longer. But for N2, we think it will be back to the old days.

Having said that, I need to remind everyone that in the old days, we're talking about corporate average of, say, 50% gross margin. Nowadays, we're talking about 53% gross margin. So it becomes less meaningful to talk about how much time it takes to catch up with corporate nowadays. But having said that, structurally, N2 does have a better profitability than N3, okay?

And N2 development is right on track. We're ramping it in the second half of this year. We expect the revenue to come up in the first half of next year.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. Thank you, Wendell. Thank you, Arthur. Let's come back to the floor. We'll go left, middle, right.

So maybe Sunny Lin from UBS.

Sunny Lin - UBS - Analyst

Very good results, and congrats. So my first question is a follow-up on CapEx. So obviously, full-year sales guidance is stronger, you are turning more constructive on high performance compute and AI, yet you are keeping your CapEx guidance. So is it fair to assume that you are considering some conservatism for CapEx for this year given the ongoing macro uncertainty? Or is it because in the short term, your capacity expansion is somewhat constrained by the ability that you can ramp up more capacity. And therefore, maybe in 2026 and 2027, we should expect some acceleration of your CapEx spending.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. So Sunny's first question is around CapEx. She notes, of course, that we raised our 2025 revenue guidance this year, and we certainly still see a very robust demand from AI, yet we kept our CapEx guidance in the same range of \$38 to \$42 (billion).

So she wants to understand why. Is it because of macro uncertainty? Is it because of constraints in the construction? And her other part of this question is what is the CapEx outlook for '26 and '27, I guess.

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

Okay. Sunny, the CapEx, as we said before, the CapEx invested in a given year is for the business opportunities in the following years. And as long as there are business opportunities, we will not hesitate to invest.

Having said that, nowadays, as C.C. also said, with all these macro uncertainties, we are mindful of these uncertainties. So we also take that into considerations in our capacity and CapEx plan.

Going forward, it's too early to talk about future years CapEx, but I can share with you a company of our size, it's unlikely that you see CapEx dollar amount suddenly drop a lot in any given year. That's all I can share with you.

Sunny Lin - UBS - Analyst

Got it. It sounds like CapEx could be going higher in the coming years.

My second question is on cloud AI. And so you -- seems like earlier attribute most of the sales upside for 2025 to cloud AI. And therefore, I wonder if you have an update on the cloud AI growth in 2025, which you guided before to be about 100% for 2025.

And the implication to your CoWoS capacity expansion. Are you able to maybe expand a bit more CoWoS capacity for this year to support a stronger cloud AI growth for this year? And any early insights that you could share with us for your CoWoS capacity expansion for 2026?

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. So Sunny's second question is asking about our AI. Well, she says cloud AI, basically, our AI accelerator growth in 2025 and related the CoWoS capacity. So her question is what is the AI accelerator revenue growth we expect in 2025? And then what is our CoWoS capacity expansion plan for 2025? And she asked a similar question to Charlie or someone earlier, what is the plan for CoWoS capacity in 2026?

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

Well, my answer stays the same. We are trying very hard to narrow the gap, for now and for 2026. The demand, the momentum are very healthy and very strong. And so we are building many new facilities in the backend to increase the CoWoS capacity to support our customers. AI demand is very strong, and so is CoWoS capacity, the demand is very strong.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. Thank you, Sunny. Then we'll move on to Laura Chen from Citi.

Laura Chen - Citi - Analyst

Congrats for the good result and outlook. My question is also about the AI chip. C.C., you mentioned that AI chip is getting bigger and bigger and also the power consumption is getting much more.

So I'm just wondering that among like your advanced technology, including like the advanced node, we also noted that during the symposium, TSMC also announced some of the new technology in advanced packaging as well.

So I'm just wondering how do you kind of prioritize your leading-edge advanced packaging. During the symposium, we see that System-on-Wafer that kind of a new design. Do you have any like plan or like timeline for the new technology? And should we think about that that should be kind of aligned with our most advanced node process like N2 or A16 going forward?

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. So Laura's first question is on advanced packaging. She notes AI, the die sizes are increasing, the need for power consumption or energy efficiency is rising. So she wants to understand how our strategy for advanced packaging along with the advanced node development. Are there any specific packaging solutions that we're prioritizing? What about the timeline and roadmap? How does that match up with our advanced node roadmap?

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

Laura, I think TSMC's philosophy to develop a technology is working with the customer. The customer has such demand, we develop the technology, we increase the capacity for them. So priorities, every customer is important to TSMC. And in the advanced packaging side, a lot of customers are using different approaches. So we are developing a variety of different back-end packaging, advanced technology for all the customers.

Whether it is related to the advanced leading-edge technology, the answer is yes. So we have system integration. We have CoWoS-L. That's the terminology. We have a lot of different names that I cannot even remember, but there's a lot of varieties, and we work with our customers to meet their demand, that I can answer you.

Laura Chen - Citi - Analyst

Is that easy to kind of leverage or transfer different kind of technology from your perspective?

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

So Laura is asking how fungible are these different packaging technologies. How interchangeable or easy to transfer the technology between different packaging solutions.

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

Of course, there are some similarities in between. Otherwise, we are going to put too much of the effort and did not get the return. Yes, there's a lot of similarities, but a lot of varieties also.

Laura Chen - Citi - Analyst

Thank you. And my second question is we know that obviously, the AI demand advanced node, advanced leading-edge packaging is very tight. But I'm just wondering that industry-wise, we still see probably overcapacity in mature nodes.

Yet TSMC also have like more mature 16-nanometer or above that kind of process. So can we kind of consolidate our mature nodes to kind of make better efficiency and capabilities to enhance the -- like those capacity to fulfill the demand across the board?

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. So Laura's second question is on mature nodes. She notes that there is overcapacity on the industry-wide in older nodes. So she wants to understand for TSMC specifically, if we take, for example, 16-nanometer and older nodes, what is our strategy? Can we consolidate amongst the different nodes? How do we protect our profitability?

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

Good question. If you read the newspaper, there are so much of mature node capacity. TSMC's strategy actually is on the mature node technologies. We develop kind of specialties. For example, that RF technology or CMOS image sensor or the high voltage.

So we develop the technology at the request of our customers. So we don't worry too much about what you say, overcapacity. If it is really overcapacity, we will not build a fab in Japan, we will not build a fab in Germany. So it's not overcapacity. It's all related to customers' need, customers' demand, and those are all specialty technologies.

Did I answer your question?

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. Thank you, Laura. I think in the interest of time, we'll go to Brad Lin from Bank of America. Then we'll take one more from the line and then if there's one more from the floor.

Brad Lin - Bank of America - Analyst

I have two questions. My first one is on the humanoid robot. So we have learned that humanoid robot started to contribute to TSMC, and it is gaining momentum as the next frontier of the AI hardware. How does TSMC evaluate the market size of humanoid robot in the semiconductor and in terms of the potential market TAM, compute, and also sensor requirements? And do you think that might be another driver potentially for mature nodes, too?

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. Thank you, Brad. So Brad's first question is around humanoid robots. We're starting to see some contribution. He wants to understand how do we evaluate the market size. What is the addressable opportunities for TSMC in the long term at the leading edge and also on the mature nodes with certain type of specialty?

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

Brad, it's too early. Actually, it's too early to say the humanoid robot will play a role in this year. Next year, probably it's still too early because it's so complicated. You know that the humanoid robot, well, most of the time will be used -- I think the first one will be used in medical industry to take care of the people getting old like me. And probably someday, I need some humanoid robot to help me.

But it's very complicated because we are talking about the brain only, actually, you're talking about a lot of sensor technology, that's the image sensor, the pressure sensor, the temperature sensor, and all the feedback to the CPU. And so it's very complicated.

And since it's dealing with human being directly, it has to be very, very careful. But then once they start to fly, it was a big, big plus. I talked to one of my customers, and he said that the EV car is nothing, his robot will be 10 times of that. I'm waiting for that. Okay.

Did that answer your question?

Brad Lin - Bank of America - Analyst

Yes, yes. I believe the client definitely owns EV cars and robots, too, so he knows it well.

So my second question will be on the potential pulling ahead of the so-called reflecting the value into 2026. So we know, well, normally, we continue to reflect the value into our pricing. So given the potentially higher pricing into 2026, are you observing any signs of demand pulling from the customers in the second half of the year?

And potentially, well, given the tight pipeline of N3 and N5, will we see a continued strength into 4Q, even though we already guided potential decline, but yeah, any pulling in potentially?

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. Brad, second question, very specifically, he's asking as C.C. talked about that we will continue to earn our value, do we see any customers trying to pull in their demand ahead of 2026 into the second half of this year? And do we have any additional comments to offer on the fourth quarter besides what we have already shared?

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

Well, the answer is no. We do not see any different customers or behavior so far, okay? But let me share with you and add more color. If you are talking about the 3-nanometer's demand, for example, the cycle time itself will take about four months. So there's no way you can pull in anything.

I mean that's -- yeah, and we have -- as I said, our capacity is very, very tight. So we already have all the schedules. And so very little room for pull-in, let me say that, even they want it. But, No. The answer is no. So 2026 is 2026, we will share with you.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Thank you, C.C. Thank you, Brad. All right. Operator, we'll take questions from the last participant on the line.

Operator

Mehdi Hosseini, SIG.

Mehdi Hosseini - SIG - Analyst

The first one has to do with capital intensity. When I look at the past five years, when you were ramping N3 and N5, the capital intensity was at or above 40%. And you also highlighted how N2 tape-out is tracking better than N3 and N5 combined.

Does that imply that the capital intensity would need to go back up to 40%? In other words, an initial investment for N2 to accommodate these tape-outs? Is that the right way of thinking about how the investment are going to play out? And I have a follow-up.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay, Mehdi. Sorry, we couldn't hear you exactly clearly. Let me try to summarize your question, all right, which is -- Mehdi's question is around capital intensity. He notes that in the past, when we invest in new nodes or structural, the megatrends like we have with N3 and N5, our capital intensity has jumped up to greater than 40%.

So if I heard you correctly, Mehdi, your question is this time we talked about the strong demand for 2-nanometer multi-year upcoming. What is our expectation on capital intensity? Is that correct, Mehdi?

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

As we just said, the capital expenditures that invested in any given year is for future growth opportunities. So if we do our job right, the growth in the next few years is likely to exceed the growth in CapEx dollars. Even though, as I said, the CapEx dollars is unlikely to drop significantly in any given year, so you see a higher growth in revenue than the growth in capital expenditure, then you don't have such a high capital intensity. We actually demonstrated that in the past few years.

And also, let me just share with you that because of this, we're not operating setting a capital intensity as a goal. The dollar amount invested is really on the structured demand growth in the following years. So talking about capital intensity is also less meaningful than before.

Mehdi Hosseini - SIG - Analyst

Thank you. And a follow-up for me. You highlighted N2P. I'm sorry, you highlighted A16, which would be very applicable for high performance compute. Is that the node where AI and HPC would actually be at par with smartphone as an end market that would drive demand for the most leading edge node?

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Sorry, Mehdi, again, I apologize. We apologize. I could not hear you clearly, but I think his question is about on A16 where we said it's more for specific HPC-related offering. So his question is -- I think, Mehdi, your question is, is that where the AI demand also comes in for the 2-nanometer family?

Mehdi Hosseini - SIG - Analyst

Yes. And I asked that because so far, AI has been N plus 1, N plus 2. Is that node A16 the first node where AI would move to the leading edge?

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. His question -- okay, maybe let me rephrase it. I think I understand, but his question is really about AI adoption of the leading-edge node, the N node. I see smartphone, we see HPC. His question is very specifically, how do we see the AI adoption of the most leading node for TSMC. He observes in the past, it has generally been one node behind. So how do we see that going forward with things such as A16?

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

Well, Mehdi, you are right. Usually, the HPC's customers are always one step behind using N plus 1 or N plus 2 technologies. Now because of AI demand is so strong, that's one thing. But the most important thing is they need some kind of performance, but the power consumption is very, very important.

And when we talk about A16, we have another power efficiency improvement close to 20%. That's a big value for all the AI data centers applications. So that help my customer moving faster because of every time when we talk about the AI data center, if you notice that the first thing they talk about is power supply, electricity, right? So they did not tell you, say the power efficiency is very important, but they tell you that we had to build a very big electricity power plant to support the AI data center. So that tells you how important it is.

And TSMC is a technology, by the way. A16 is a further improvement of the N2 node, so it's not a surprise for TSMC to expect for those people in AI datacenter industry, they want to use A16.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. Thank you, C.C. Thank you, Mehdi. We'll take the last question from the floor. We have one participant here. Felix Pan from KGI.

Felix Pan - KGI - Analyst

I only have one question about the overseas expansion. I think C.C. earlier mentioned that the second fab for N3, there's a strong demand. So you guys need to speed up several quarters for that. Together with, I think, the US government also raised the investment tax credit cap for next year. So I wonder how this shape or how this speed up your ramping schedule for the second fab and how this impact to the overseas fab dilution for the guidance Wendell has given earlier.

I think the follow-up question will be, if you guys speed up the US investment, is that impact to other regional fabs, like Japan and Germany as well? And lastly, is that possible to break down the overseas capex and domestic capex going forward? That's all my questions.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Two questions. Okay. So Felix's question on our overseas expansion plans. He notes that, yes, C.C. said we're speeding up the schedule for the second fab in the US. So how -- and he also notes the recent passage of the US ITC bill. So how does this impact or affect our ramp schedules in our US expansion? And what is the implication or impact to the overseas dilution? That's number one.

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

Well, that's two questions. Okay. Let me share with you about our ramp-up schedule. It's totally because of our customers' demand. And we appreciate the US government increased the ITC from 25% to 35%. We appreciate that. It helped.

But the real schedule is because of our customers' demand. So we have to prepare the capacity to meet their demand. That's the number one consideration.

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

The margin impact, it is positive, although not that significant in the five-year period. Think about this, the ITC is used to offset the asset value. And the benefit comes when depreciation starts. So it gets amortized.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Okay. And then Felix's second question is how does the ramp and speed up of the US cluster expansion, how is this impacting our expansion plans in Japan and Europe, if it does at all?

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

Well, you think about TSMC expansion, the overseas fab. In the US, it's a leading edge. In Japan, it's special technology. To be specific, most of the time, it's for the CMOS sensor, automotive industry.

So they are all not in the same field. So actually, it's not affect -- the investment in the US or investing on the leading edge does not affect the investment in Japan or in Germany.

Jeff Su - Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relations

Thank you, C.C. Thank you, Felix. Okay, everyone. So this concludes our question-and-answer session. Before we conclude today's conference, please be advised that the replay of the conference will be accessible within 30 minutes from now. The transcript will become available 24 hours from now, and both are going to be available through TSMC's website at www.tsmc.com.

So thank you very much 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 good day. Thank you.

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